Advant® OCS
with Master software

Advant® Controller 450RMC*2.3

User’s Guide

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Chapter 1 Introduction

1.1 General

Advant Controller 450RMC is a programmable system for control and supervision of processes and equipment in metal industrial environments. The Advant Controller 450RMC is an extension of the programmable system Advant Controller 450.

The RMC products adds functionality and improves certain performance to the Advant Controller 450RMC

This manual is primarily intended for plant designers, commissioning and maintenance personnel. It is intended to provide the user with knowledge of the Advant Controller 450RMC products regarding possibilities and limitations.

This document does not describe the RPC-function and the RPC PC elements included in the option QC04-RPC01.

This manual does not deal with any general information regarding the Advant Controller 450 system.

1.2 Available RMC products

QC08-BAS02

Base system for Advant Controller 450RMC single and multiprocessor systems.

QC08-BAS02 is based on the basic system QC02-BAS21 for Advant Controller 450.

QC08-BAS01

Base system for Advant Controller 450RMC single and multiprocessor systems. The base system is designed for RPC (Rapid PC) applications.

QC08-BAS01 is based on the basic system QC02-BAS21 for Advant Controller 450.

QC08-RMC01

Option module for Advant Controller 450RMC single and multiprocessor systems.

QC04-RPC01

Option module for Advant Controller 450RMC single and multiprocessor systems. This option requires the base system QC08-BAS01.

QC04-VIP01

Option module for Advant Controller 450RMC single and multiprocessor systems.

Chapter 2 PC element library

2.1 General

This chapter gives a brief overview of PC elements included in option QC08-RMC01.

2.2 Cascade control

Element	Description
CTRL-H1	Generation of automatic loop control deviation and correction of the speed reference according to sequence control and measured loop position.
LSCAN-R	Reading loop position, material detection and material temperature from circuit board DSDP161.
LSCAN-W	Initialization of PC element LSCAN-R and circuit board DSDP161.
READ-H1	Reading loop position and material detection from circuit board DSDP160.
SETR-H1	Auto and manual control of R-factor.
TRAC-H1	Length measurement for head and tail tracking through a rolling mill. Setting of three warning flags and one length dependent flag. Cobble detection alarm function. Late head, tail material detection alarm function.
MDIN-H1	Interlocking of material detection signal in rolling mills. False head, end detection alarms.
SEQ-H1	Sequence control and logics of overriding control functions in rolling mills.
CONF-H2	Control of drive configuration set up of rolling mill, overriding auto loop or min tension control set up.
CONFIG	Control of drive configuration set up of rolling mill, overriding auto loop or min tension control set up.

Table 2-1. PC elements for cascade control

2.3 Bit manipulation

Element	Description
ISR	Set/reset bits in an Integer
ITGLE	Toggle bits in an Integer
ICOPY	Copy bits into an Integer
IAOR	AND/OR bit manipulation
I-DEMUX	Conversion of an Integer into a number of Boolean signals

Table 2-2. PC elements for bit manipulation

2.4 Positioning control

Element	Description
POSW-H1	Interface for reading control and error signals and dynamic data from positioning board DSDP140B.
POSR-H1	Interface for writing control signals and dynamic data to positioning board DSDP140B.
CLCK-H1	Initiation and reset routine for circuit board DSDP150.
START-H1	Interface routine to create a start pulse for positioning board DSDP140B with a digital output on circuit board DSDP150.
PULSE-H1	Interface routine to create a single pulse of controlled duration and pulse width on a DSDP150 digital output board.
LINT-H1	Length integrator for head or tail.
TIME-H1	Interface routine for reading of system clock located on circuit board DSDP150.
PULSE-C	Pulse counter element for circuit board DSDP150.

Table 2-3. PC elements for positioning control

2.5 Communication

Element	Description
PCC-RD	Communication element for reading of data from corresponding PCC-WR element located in same or another CPU system within a multiprocessor system.
PCC-WR	Communication element for writing of data to corresponding PCC-RD element located in same or another CPU system within a multiprocessor system.
HPC-RD	Interface element for reading of data from circuit board DSCS160 used for HPC, High Performance Communication.
HPC-WR	Interface element for writing of data to circuit board DSCS160 used for HPC, High Performance Communication
FDC-W	Write element for fast communication on the AF100 bus.
FDC-R	Read element for fast communication on the AF100 bus.
STAPC-W	Write element for fast communication on the AF100 bus to an APC.
RFAPC-R	Read element for fast communication on the AF100 bus from an APC.
DI-RD	Reading and configuration of an absolute parallel binary coded incremental sensor.
DI-RE	Fast reading of absolute parallel binary coded incremental sensors.
RSCOM-WR	Sending text lines to an RS232 device.
TEXT-LN	Calculation of actual length of text lines
VIP-NETW	Used for configuration and supervision of a VIP network in order to communicate via TCP/UDP links to external computers.
VIP-NODE	Used for configuration and supervision of nodes connected to a VIP network.
VIP-LINK	Used for configuration and supervision of TCP and UDP links to an external computer.
VIP-CHAN	Used for configuration and supervision of channels for a TCP/UDP link.
VIP-R	Provides the application program with an interface for receiving data on a TCP/UDP link from an external computer.
VIP-W	Provides the application program with an interface for sending data on a TCP/UDP link to an external computer.
TIME-CON	Used for conversion of date and time into internal system time representation.
TIME-SET	Used for setting of date and time in the internal system time representation.

Table 2-4. PC elements for communication

2.6 Furnace control

Element	Description
ADD-G	Addition of group data elements.
DIV-G	Division of group data elements.
MUL-G	Multiplication of group data elements.
SUB-G	Subtraction of group data elements.
REG-GMI	Group data register with memory.

Table 2-5. PC elements for furnace control

2.7 Least Square Calculation

Element	Description
DEREG-AI	Disassemble individual variables from an array of data type I.
DEREG-AR	Disassemble individual variables from an array of data type R.
LSQ-PARA	Calculates one of the parameters of a least squares fit of a function to measured values.
LSQ-PREP	Performs preparation of the target functions for the estimation calculation.
LSQ-PSEU	Preparation of a pseudo-function for the least squares method
LSQ-REST	Calculation of the remaining error after a least square fit of a function to measured values.
REG-AI	Assembles individual variables of data type I to a single variable of array type with leading STATUS, LPOS and HPOS.
REG-AR	Assembles individual variables of data type R to a single variable of array type with leading STATUS, LPOS and HPOS.

2.8 Miscellaneous

Element	Description
AIR	Interface element for direct access of analog input channels
AOW	Interface element for direct access of analog output channels.
BCD-RD	Reading of data from digital input board DSDI 110.
BCDW-H1	Writing of data to digital output board DSDO 110.
CHOS-H1	Change of state detection.
REG-LD	Register element to delay transducer values of a processed material in a feed-forward control application.
REG-TOT	Register element to delay transducer values of a processed material in a feed-forward control application.
MV320CYC	Changing of updating time for a MV320 display.
RAMP-SH	Generation of an S-shaped ramp signal.
RAMP-SSH	Generation of an S-shaped ramp signal with a balancing function.
TRIGON	Trigonometric functions
MEAN-R	Mean value calculator for data type real (R).
STRIP-TR	Strip tracking on Operator Stations.
SHIFT-BG	Shift register element for barographs.
LED-DW	Control of cascaded display units.
TBL-SRCH	Searching of table data.

Table 2-6. Miscellaneous PC elements

Chapter 3 Modified Advant Controller 450 standard functions

3.1 Data Set Communication

The base time for Data Set communication is 100 ms.
This parameter can however be changed by the user through the APP command.

3.2 Updating times for cyclic subscription

The updating times for signals/objects from Advant Controller 450RMC used in Operator Station are 333 ms, 1s and 3s.

When calculating the load in the Operator Station the new faster updating times must be considered

Type	**Description**
0	No updating
1	Updating only during display exchange
2	Updating only during display exchange plus event controlled updating
3	Updating according to 2 above plus cyclic updating interval 333 ms
5	As 3 above but cyclic updating each second
6	As for type 3, but cyclic updating every third second

Table 3-1. Subscription types

Chapter 4 Subracks used by the Advant Controller 450RMC

4.1 General

The database element AC450_1 represent PM511V CPU nodes in the Advant Controller 450RMC. In this element is the subrack type described.

4.2 Subrack RF533 (8-slots)

The 8-slots subrack is the default type in the data base element AC450_1. In this data base element the 8-slot rack is called RF520.

4.3 Subrack RF522 (14-slots)

The subrack type in data base element AC450_1 has to be changed from the default type RF520 to RF521 when the subrack RF522 (14-slots) is used. RF522 is based on RF521.

Chapter 5 Multiprocessor system considerations

5.1 General

An Advant Controller 450RMC multiprocessor system can have two different subracks (8-slots and 14-slots). The eight slots subrack may contain up to three PM511V (CPU) boards. Figure 4-1 shows the disposition of boards in the eight slots subrack with two CPU systems. The fourteen slots subrack may contain up to four PM511V(CPU) boards. Figure 4-2 shows the disposition of boards in the fourteen slots subrack with four CPU systems.

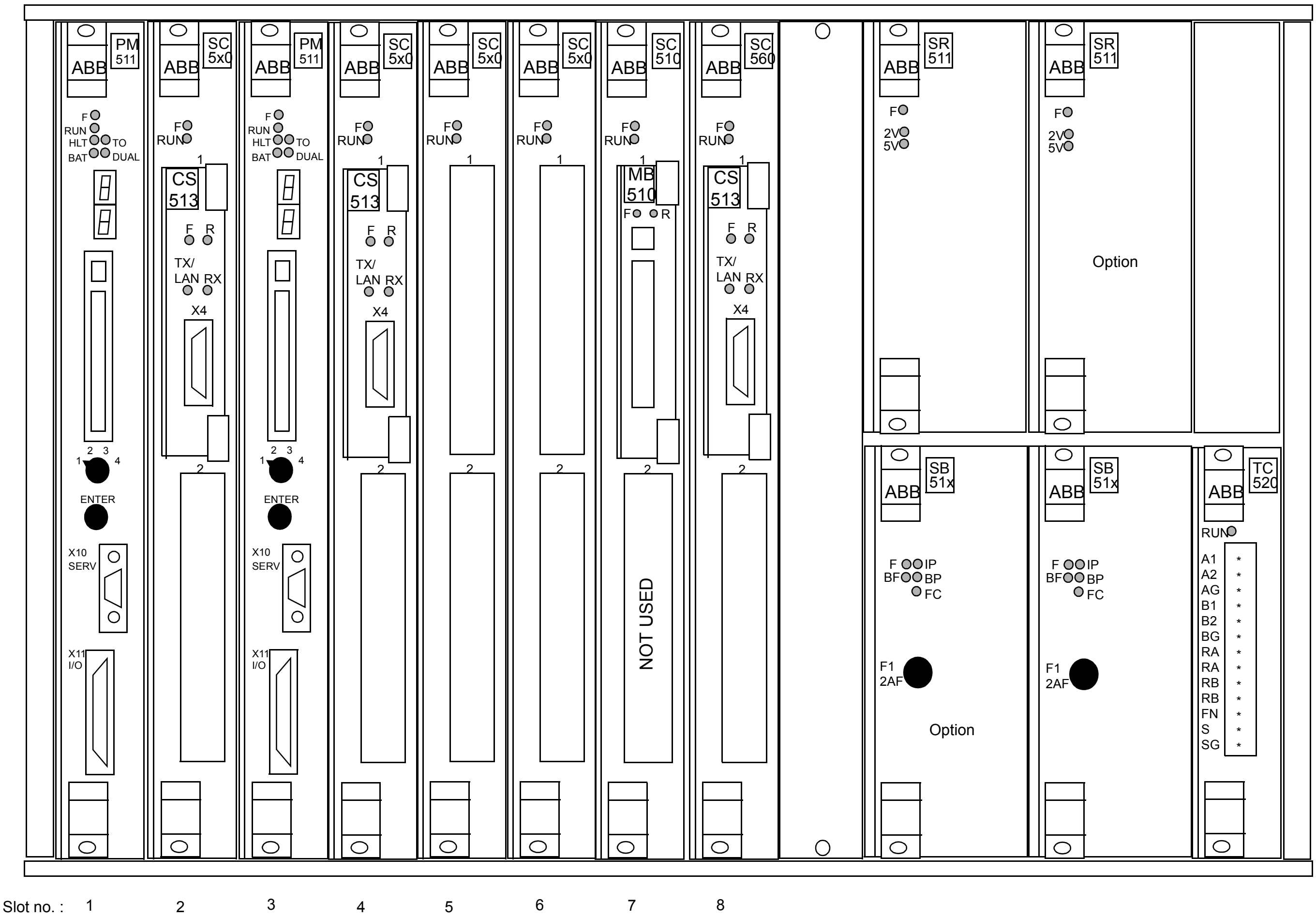


Figure 5-1. Disposition of boards in the 8-slots with two CPUs.

In figure 4-1 the 8-slots subrack is equipped with redundant voltage regulator SR511 (which is marked “option”) and redundant power supply SB51x for battery backup (which is marked “option”).

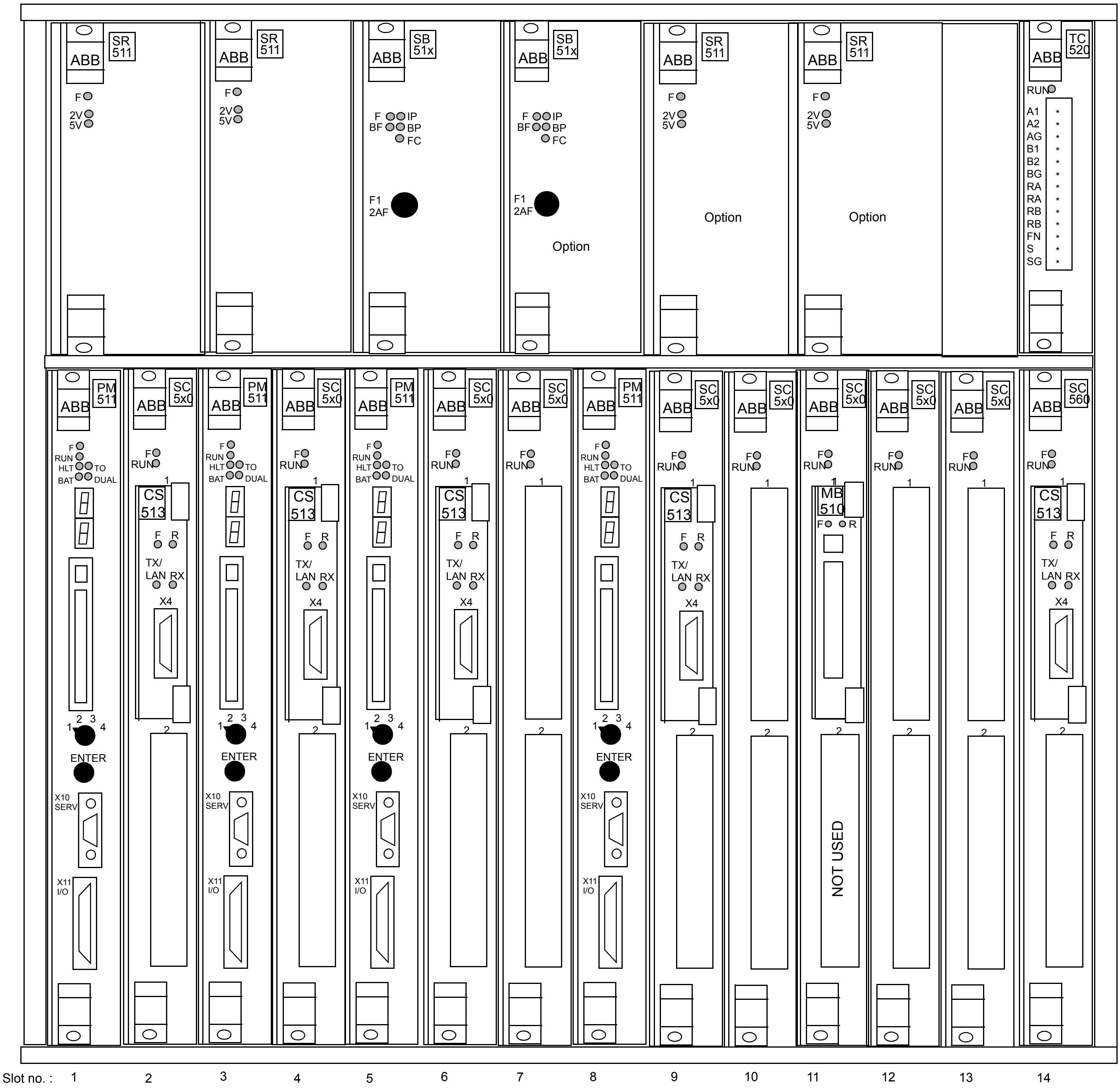


Figure 5-2. Disposition of boards in the 14-slots subrack with four CPUs.

In figure 4-2 the 14-slots subrack is equipped with redundant voltage regulators SR511 (which is marked “option”) and redundant power supply’s SB51x for battery backup (which is marked “option”).

5.2 General positioning of circuit boards in the subrack

This chapter describes the rules for positioning of CPU-boards PM511V and carrier boards.

PM511V CPU's in the multiprocessor system can normally **not** share carrier boards.

PM511V CPU's in the multiprocessor system can, however, share the carrier boards which hold the submodule MB510 (holds program card) or the carrier board SC560 for HPC-communication.

CS513 or CS513A boards for MB300 communication must be mounted on the right side and directly next to the CPU it is serving.

CI546 (TCP/IP-VIP) or CI543 (GCOM) should not be mounted on the same carrier board as CS513 or CS513A modules for MB300 communication.

5.2.1 Advant Controller 450RMC with 8-slots subrack

5.2.1.1 Advant Controller 450RMC, single system (one CPU)

	Positioning in 8-slots subrack	
	Without HPC-communication	**With HPC-communication**
PM511V in slot 1	Slot 1	Slot 1
Flash card with application program dump for PM511V in slot 1	Slot 1 on PM511 CPU	Slot 1 on PM511 CPU
MB300 for PM511V in slot 1	Slot 2	Slot 2
GCOM and VIP (TCP/IP) for PM511V in slot 1	Any free slot except 2	Any free slot except 2
Flash card with system software for PM511V in slot 1	Slot 1 or 7, if ACM is used slot 1 or 6, see note 1.	Slot 1 or 7, if ACM is used slot 1 or 6, see note 1.
SC 560 for HPC communication	-	Slot 8, if ACM is used slot 6

Table 5-1. Positioning in 8-slots subrack, single systems

Note 1: The flash card with system software's can be positioned:

1 On the PM511 CPU, if back up of application program in flash card is not used.

2 On a MB510 submodule to the right of the CPU. This method must be used when the flash card slot in the CPU is occupied by an application backup. The SC510 holding the MB510 will also be used as common memory.

Submodules for EXCOM etc. are placed on free positions on carrier boards.

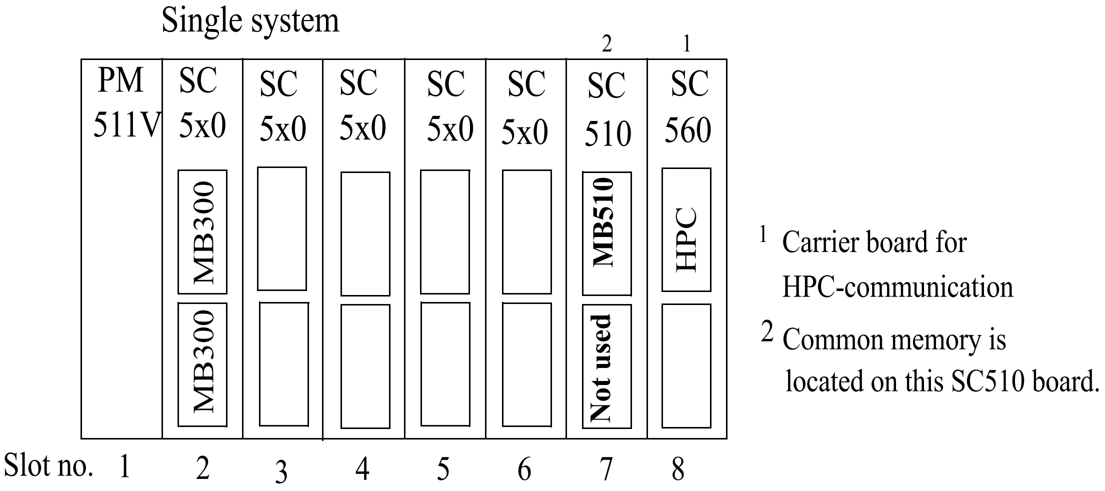


Figure 5-3. Example of positioning one PM511V and carrier boards.

5.2.1.2 Advant Controller 450RMC, multi processor system with two CPUs

	Positioning in 8-slots subrack	
	Without HPC-communication	**With HPC-communication**
PM511V in slot 1	Slot 1	Slot 1
Flash card with application program dump for PM511V in slot 1	Slot 1 on PM511 CPU	Slot 1 on PM511 CPU
MB300 for PM511V in slot 1	Slot 2	Slot 2
GCOM and VIP (TCP/IP) for PM511V in slot 1	Any free slot except 2 or 4.	Any free slot except 2 or 4.
Flash card with system software for PM511V in slot 1	Slot 1 or 7, if ACM is used slot 1 or 6, see note 1.	Slot 1 or 7, if ACM is used slot 1 or 6, see note 1.
PM511V in slot 3	Slot 3	Slot 3
Flash card with application program dump for PM511V in slot 3	Slot 3 on PM511 CPU	Slot 3 on PM511 CPU
MB300 for PM511V in slot 3	Slot 4.	Slot 4
GCOM and VIP (TCP/IP) for PM511V in slot 3	Any free slot except 2 or 4.	Any free slot except 2 or 4
Flash card with system software for PM511V in slot 3.	Slot 3 or 7, if ACM is used slot 3 or 6, see note 1.	Slot 3 or 7, if ACM is used slot 3 or 6, see note 1.
SC 560 for HPC communication	-	Slot 8, if ACM is used slot 6

Table 5-2. Positioning in 8-slots subrack, multiprocessor system with two CPUs

Note 1: The flash card with system software's can be positioned:

1. On the PM511 CPU, if back up of application program in flash card is not used.
2. On a MB510 submodule to the right of the CPU. This method must be used when the CPU flash card slot is occupied by an application backup. The SC510 holding the MB510 will also be used as common memory.

Submodules for EXCOM etc. are placed on free positions on carrier boards.

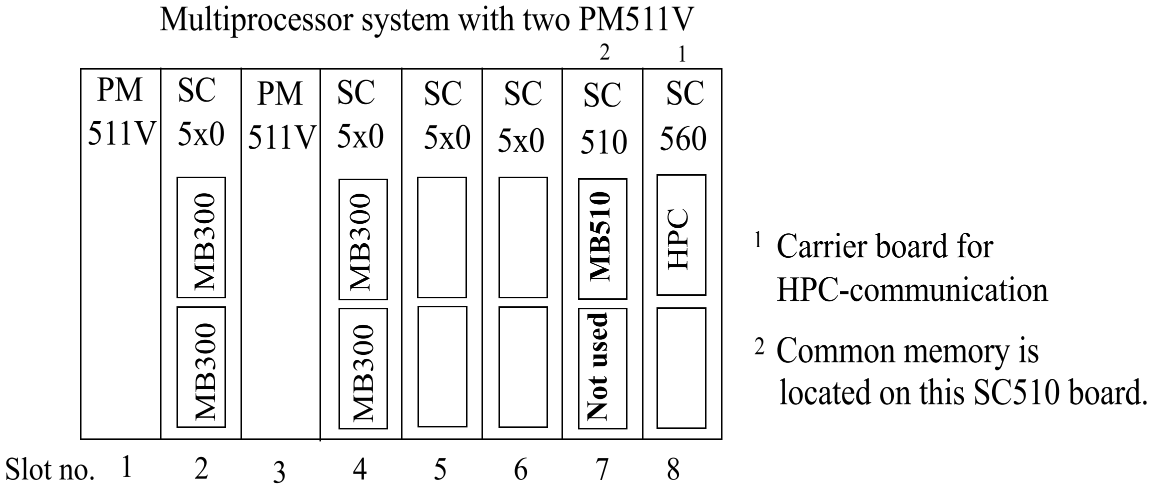

Multiprocessor system with two PM511V
PM 511V
SC 5x0
MB300
MB300
PM 511V
SC 5x0
MB300
MB300
SC 5x0
SC 5x0
SC 510 2
MB510
Not used
SC 560 1
HPC
1 Carrier board for HPC-communication
2 Common memory is located on this SC510 board.
Slot no. 1 2 3 4 5 6 7 8

Figure 5-4. Example of positioning two PM511V and carrier boards.

5.2.1.3 Advant Controller 450RMC, multi processor system with three CPUs

	Positioning in 8-slots subrack	
	Without HPC-communication	**With HPC-communication**
PM511V in slot 1	Slot 1	Slot 1
Flash card with application program dump for PM511V in slot 1	Slot 1 on PM511 CPU	Slot 1 on PM511 CPU
MB300 for PM511V in slot 1	Slot 2	Slot 2
GCOM and VIP (TCP/IP) for PM511V in slot 1	Any free slot except 2, 4 or 8.	Any free slot except 2, 4 or 8.
Flash card with system software for PM511V in slot 1	Slot 1 or 6, see note 1	Slot 1 or 5, see note 1
PM511V in slot 3	Slot 3	Slot 3
Flash card with application program dump for PM511V in slot 3	Slot 3 on PM511 CPU	Slot 3 on PM511 CPU
MB300 for PM511V in slot 3	Slot 4	Slot 4
GCOM and VIP (TCP/IP) for PM511V in slot 3	Any free slot except 2, 4 or 8	Any free slot except 2, 4 or 8
Flash card with system software for PM511V in slot 3.	Slot 3 or 6, see note 1	Slot 3 or 5, see note 1
PM511V in slot 7	Slot 7	Slot 7
Flash card with application program dump for PM511V in slot 7	Slot 7 on PM511 CPU	Slot 7 on PM511 CPU
MB300 for PM511V in slot 7	Slot 8	Slot 8
GCOM and VIP (TCP/IP) for PM511V in slot 7	Any free slot except 2, 4 or 8	Any free slot except 2, 4 or 8
Flash card with system software for PM511V in slot 7.	Slot 7 or 8, see note 1	Slot 7 or 8, see note 1
SC 560 for HPC communication	-	Slot 6

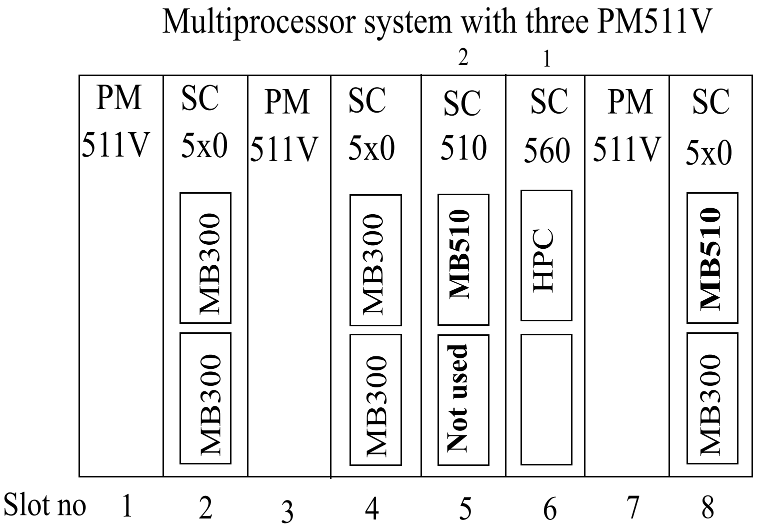
Table 5-3. Positioning in 8-slots subrack, multiprocessor system with three CPUs

Note 1: The flash card with system software's can be positioned:

1. On the PM511 CPU, if back up of application program in flash card is not used.
2. On a MB510 submodule to the right of the CPU. This method must be used when the CPU flash card slot is occupied by an application backup. The SC510 holding the MB510 will also be used as common memory.

OBSERVE **This configuration requires two program cards, see also figures on next page.**

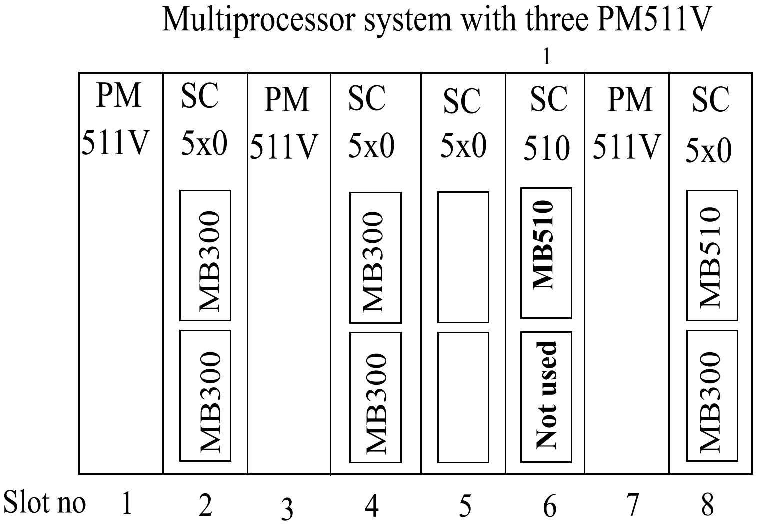
Submodules for EXCOM etc. are placed on free positions on carrier boards



[1] Carrier board for HPC-communication

[2] Common memory is located on this SC510 board.

Figure 5-5. Positioning three PM511V CPUs and carrier boards.



[1] Common memory is located on this SC510 board.

Figure 5-6. Positioning three PM511V CPUs and carrier boards.

5.2.2 Advant Controller 450RMC with 14-slots subrack

5.2.2.1 Advant Controller 450RMC, single processor system (one CPU)

	Positioning in 14-slots subrack
PM511V in slot 1	Slot 1
Flash card with application program dump for PM511V in slot 1	Slot 1 on PM511 CPU
MB300 for PM511V in slot 1	Slot 2
GCOM and VIP (TCP/IP) for PM511V in slot 1	Any free slot except 2.
Flash card with system software for PM511V in slot 1	Slot 1 or 11, see note 1
SC 560 for HPC communication	Slot 14

Table 5-4. Positioning in 14-slots subrack, single system

Note 1: The flash card with system software's can be positioned:

1. On the PM511 CPU, if back up of application program in flash card is not used.
2. On a MB510 submodule to the right of the CPU. This method must be used when the CPU flash card slot is occupied by an application backup. The SC510 holding the MB510 will also be used as common memory.

Submodules for EXCOM etc. are placed on free positions on carrier boards.

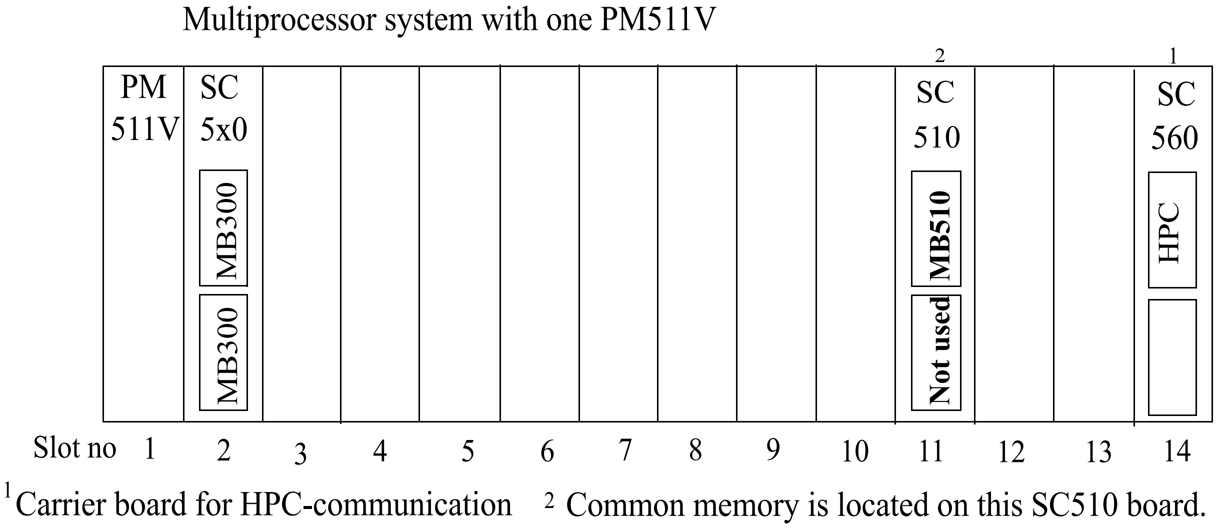

Multiprocessor system with one PM511V
PM 511V
SC 5x0
MB300
MB300
2
SC 510
MB510
Not used
1
SC 560
HPC
Slot no 1 2 3 4 5 6 7 8 9 10 11 12 13 14
1 Carrier board for HPC-communication
2 Common memory is located on this SC510 board.

Figure 5-7. Example of positioning one PM511V and carrier boards.

5.2.2.2 Advant Controller 450RMC, multi processor system with two CPUs

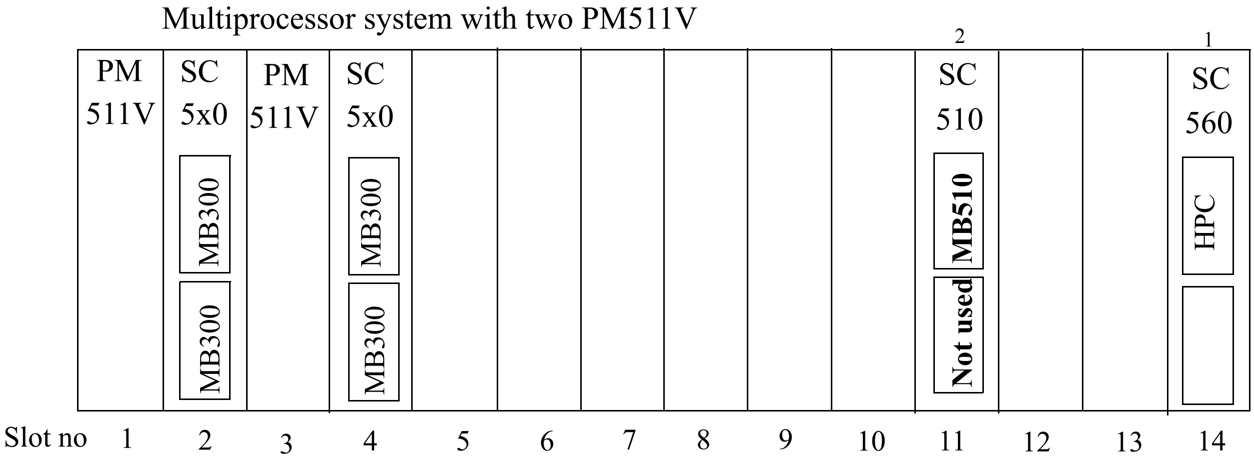
	Positioning in 14-slots subrack
PM511V in slot 1	Slot 1
Flash card with application program dump for PM511V in slot 1	Slot 1 on PM511 CPU
MB300 for PM511V in slot 1	Slot 2
GCOM and VIP (TCP/IP) for PM511V in slot 1	Any free slot except 2 or 4
Flash card with system software for PM511V in slot 1	Slot 1 or 11, see note 1
PM511V in slot 3	Slot 3
Flash card with application program dump for PM511V in slot 3	Slot 3 on PM511 CPU
MB300 for PM511V in slot 3	Slot 4
GCOM and VIP (TCP/IP) for PM511V in slot 3	Any free slot except 2 or 4
Flash card with system software for PM511V in slot 3.	Slot 3 or 11, see note 1
SC 560 for HPC communication	Slot 14

Table 5-5. Positioning in 14-slots subrack, multiprocessor system with two CPUs

Note 1: The flash card with system software's can be positioned:

1. On the PM511 CPU, if back up of application program in flash card is not used.
2. On a MB510 submodule to the right of the CPU. This method must be used when the flash card slot in the CPU is occupied by an application backup. The SC510 holding the MB510 will also be used as common memory.

Submodules for EXCOM etc. are placed on free positions on carrier boards.



[1] Carrier board for HPC-communication [2] Common memory is located on this SC510 board.

Figure 5-8. Example of positioning two PM511V and carrier boards.

5.2.2.3 Advant Controller 450RMC, multi processor system with three CPUs

	Positioning in 14-slots subrack
PM511V in slot 1	Slot 1
Flash card with application program dump for PM511V in slot 1	Slot 1 on PM511 CPU
MB300 for PM511V in slot 1	Slot 2
GCOM and VIP (TCP/IP) for PM511V in slot 1	Any free slot except 2, 4 or 6.
Flash card with system software for PM511V in slot 1	Slot 1 or 11, see note 1
PM511V in slot 3	Slot 3
Flash card with application program dump for PM511V in slot 3	Slot 3 on PM511 CPU
MB300 for PM511V in slot 3	Slot 4
GCOM and VIP (TCP/IP) for PM511V in slot 3	Any free slot except 2, 4 or 6.
Flash card with system software for PM511V in slot 3.	Slot 3 or 11, see note 1
PM511V in slot no. 5	Slot 5
Flash card with application program dump for PM511V in slot 5	Slot 5 on PM511 CPU
MB300 for PM511V in slot 5	Slot 6
GCOM and VIP (TCP/IP) for PM511V in slot 5	Any free slot except 2, 4 or 6.
Flash card with system software's for PM511V in slot 5.	Slot 5 or 11, see note 1
SC 560 for HPC communication	Slot 14

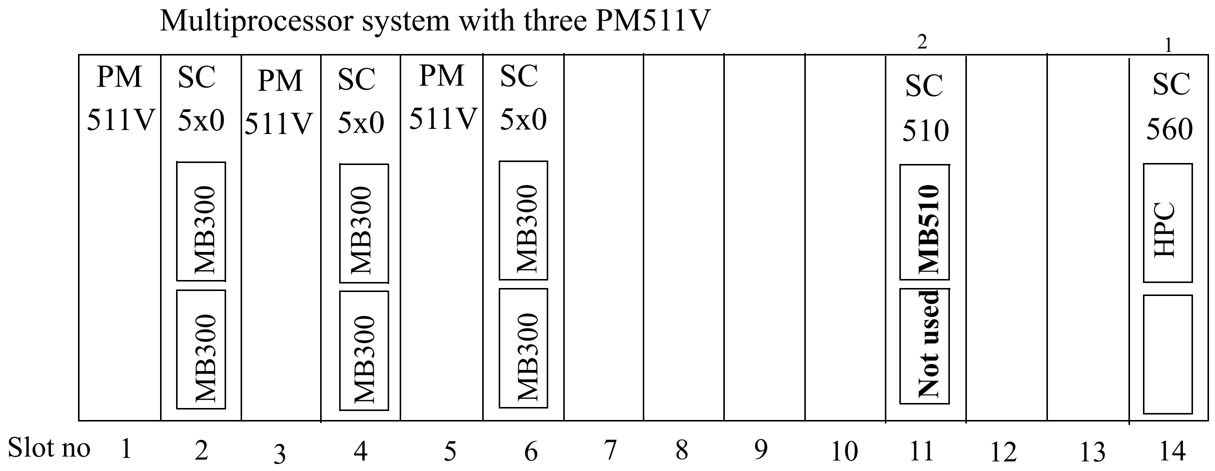
Table 5-6. Positioning in 14-slots subrack, multiprocessor system with three CPUs

Note 1:
The flash card with system software's are be positioned:

1 On the PM511 CPU, if back up of application program in flash card is not used.

2 On a MB510 submodule to the right of the CPU. This method must be used when the flash card slot in the CPU is occupied by an application backup. The SC510 holding the MB510 will also be used as common memory.

Submodules for EXCOM etc. are placed on free positions on carrier boards.



[1] Carrier board for HPC-communication

[2] Common memory is located on this SC510 board.

Figure 5-9. Example of positioning three PM511V and carrier boards.

5.2.2.4 Advant Controller 450RMC, multi processor system with four CPUs.

	Positioning in 14-slots subrack
PM511V in slot 1	Slot 1
Flash card with application program dump for PM511V in slot 1	Slot 1 on PM511 CPU
MB300 for PM511V in slot 1	Slot 2
GCOM and VIP (TCP/IP) for PM511V in slot 1	Any free slot except 2, 4, 6 or 9.
Flash card with system software's for PM511V in slot 1	Slot 1 or 11, see note 1
PM511V in slot 3	Slot 3
Flash card with application program dump for PM511V in slot 3	Slot 3 on PM511 CPU
MB300 for PM511V in slot 3	Slot 4
GCOM and VIP (TCP/IP) for PM511V in slot 3	Any free slot except 2, 4, 6 or 9.
Flash card with system software's for PM511V in slot 3.	Slot 3 or 11, see note 1
PM511V in slot 5	Slot 5
Flash card with application program dump for PM511V in slot 5	Slot 5 on PM511 CPU
MB300 for PM511V in slot 5	Slot 6
GCOM and VIP (TCP/IP) for PM511V in slot 5	Any free slot except 2, 4, 6 or 9.
Flash card with system software's for PM511V in slot 5.	Slot 5 or 11, see note 1
PM511V in slot 8	Slot 8
Flash card with application program dump for PM511V in slot 8	Slot 8 on PM511 CPU
MB300 for PM511V in slot 8	Slot 9
GCOM and VIP (TCP/IP) for PM511V in slot 8	Any free slot except 2, 4, 6 or 9.
Flash card with system software's for PM511V in slot 8.	Slot 8 or 11, see note 1
SC 560 for HPC communication	Slot 14

Table 5-7. Positioning in 14-slots subrack, multiprocessor system with four CPUs

Note 1:
The flash card with system software's can be positioned:

1. On the PM511 CPU, if back up of application program in flash card is not used.
2. On a MB510 submodule to the right of the CPU. This method must be used when the flash card slot in the CPU is occupied by an application backup. The SC510 holding the MB510 will also be used as common memory.

Submodules for EXCOM etc. are placed on free positions on carrier boards.

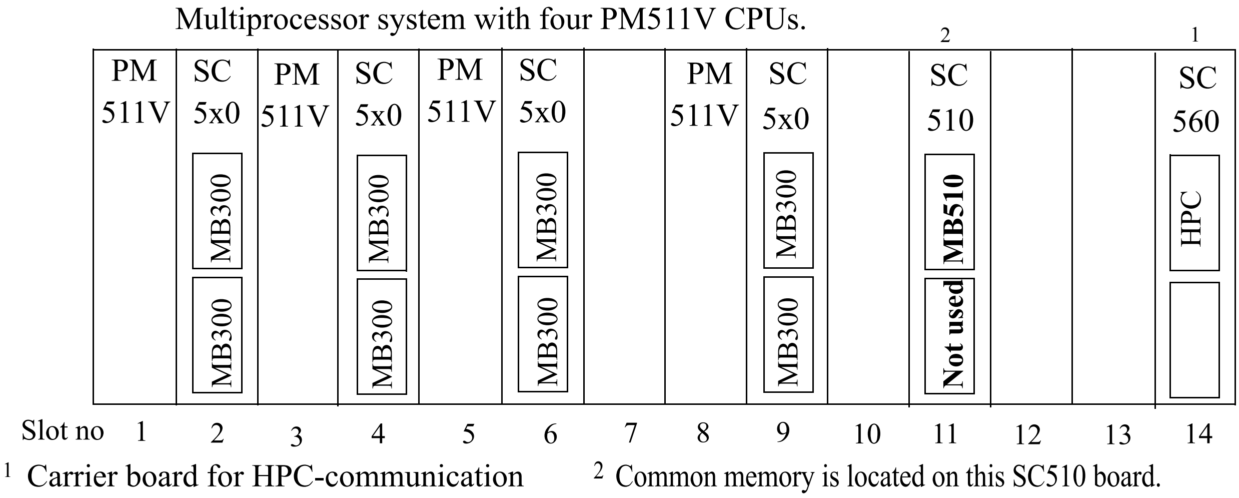

Multiprocessor system with four PM511V CPUs.
PM 511V
SC 5x0
MB300
MB300
PM 511V
SC 5x0
MB300
MB300
PM 511V
SC 5x0
MB300
MB300
PM 511V
SC 5x0
MB300
MB300
2
SC 510
MB510
Not used
1
SC 560
HPC
Slot no 1 2 3 4 5 6 7 8 9 10 11 12 13 14
1 Carrier board for HPC-communication
2 Common memory is located on this SC510 board.

Figure 5-10. Example of positioning four PM511Vs and carrier boards.

5.3 Positioning of the program card

The program card (PCMCIA) contains system software which is loaded into the CPU's at cold start, e.g. QC08-BAS02 and options such as QC07-LIB42.

A multiprocessor system could use a single or multiple program cards with system software. When more than one card is used all of them should be of the same revision, but they may contain different options or be with or without the RPC function, i.e. use QC08-BAS01 or QC08-BAS02 as basic system software.

The program card could be placed either in the PM511V CPU card slot or in a program card interface module (MB510) to the right of the CPU.

If application program dumps in flash proms is used the card slot on the CPU will be occupied. The system software must in this case be placed in a MB510.

If the CPU does not find a program card with system software in its own card slot during cold start it will search for it in MB510 modules to the right of the CPU. I.e. when a MB510 module with system software is placed to the right of all CPU's they will all use this card unless they are holding an own card. If more than one MB510 is used the CPU will use the card closest to the right of the CPU.

5.3.1 Positioning of program card(s)

5.3.1.1 Application program dumps in flash proms is not used

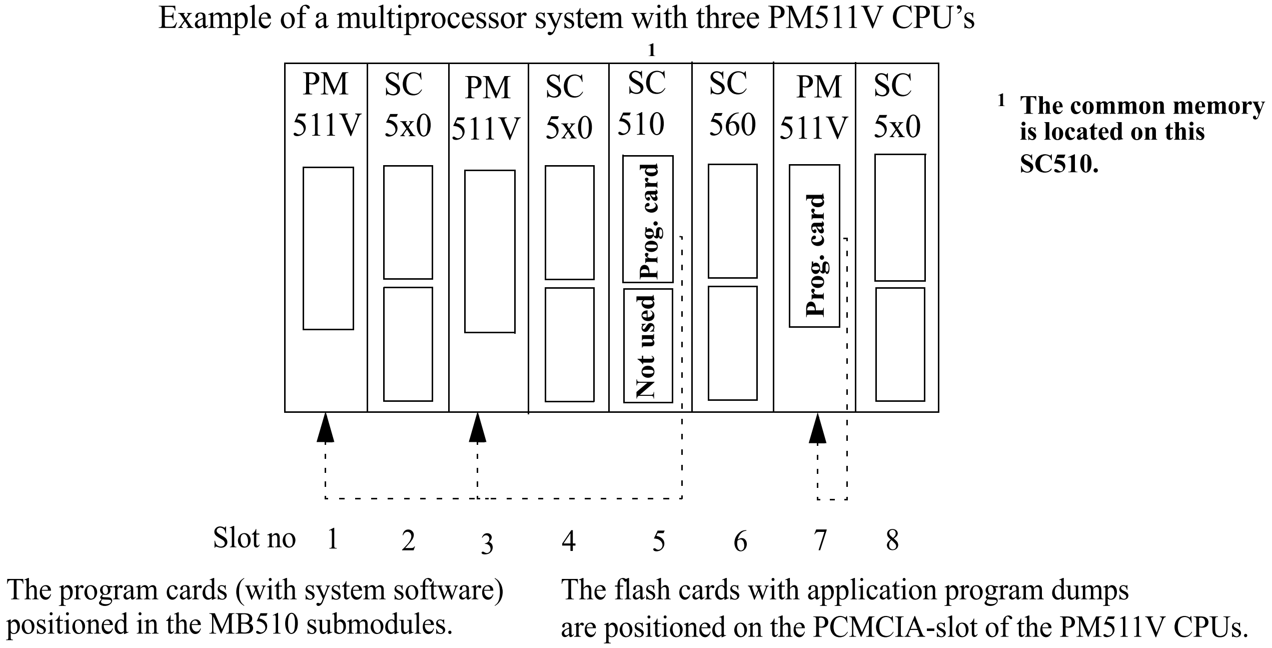

Example of a multiprocessor system with three PM511V CPU's
1
PM 511V
SC 5x0
PM 511V
SC 5x0
SC 510
SC 560
PM 511V
SC 5x0
Prog. card
Not used
Prog. card
1 The common memory is located on this SC510.
Slot no 1 2 3 4 5 6 7 8
The program cards (with system software) positioned in the MB510 submodules.
The flash cards with application program dumps are positioned on the PCMCIA-slot of the PM511V CPUs.

Figure 5-11. Example in 8-slots subrack of positioning of program cards.

Example of a multiprocessor system with four PM511V CPU's

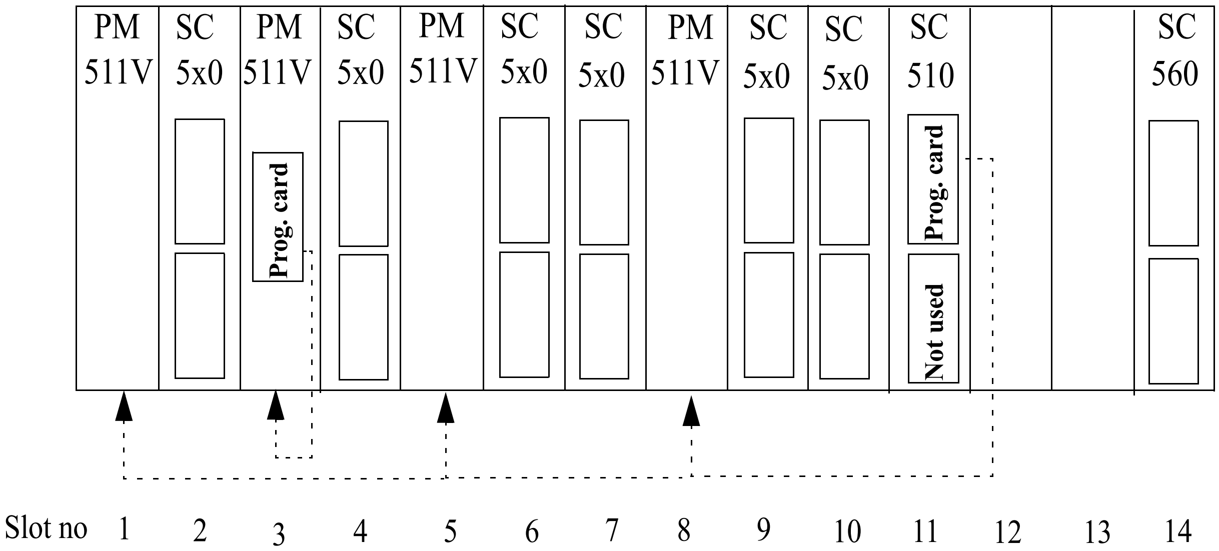
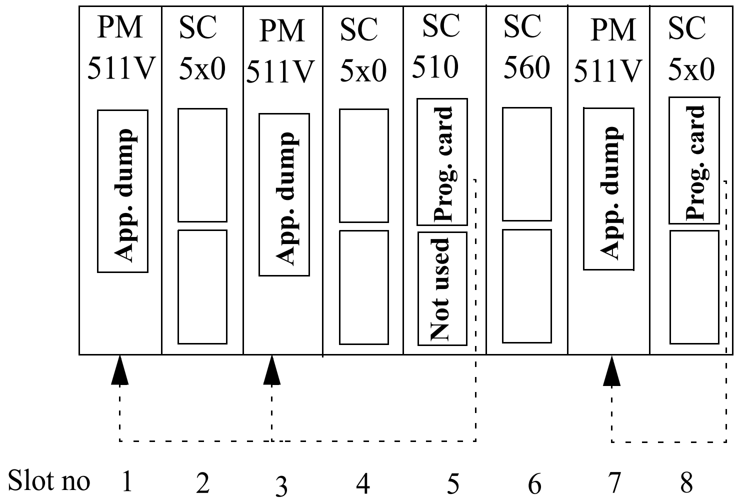


Figure 5-12. Example of positioning of program cards in 14-slots subrack.

Note
If the program card is positioned on a PM511 CPU, the working mode "STOPPED" cannot be used of this CPU, see chapter *13 Start-up of the multiprocessor system.*

5.3.1.2 Application program dumps in flash proms is used

Example of a multiprocessor system with three PM511V CPU's

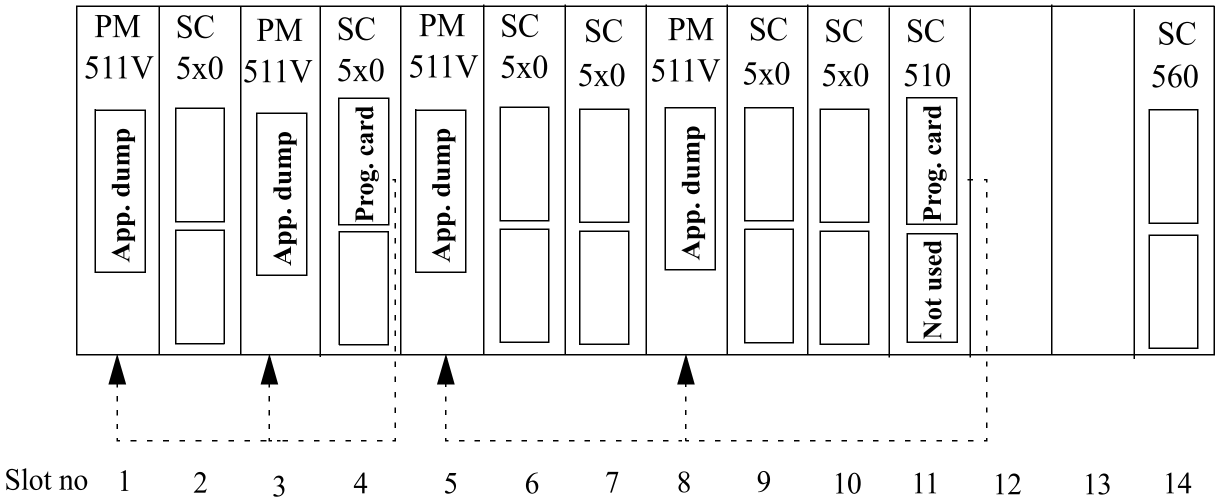


The program cards (with system software) are positioned in the MB510 submodules.

The flash cards with application program dumps are positioned on the PCMCIA-slot of the PM511V CPUs.

Figure 5-13. Example in 8-slots subrack of positioning of program cards and flash cards with application program dumps.

Example of a multiprocessor system with four PM511V CPU's



The program cards (with system software) are positioned in the MB510 submodules.

The flash cards with application program dumps are positioned on the PCMCIA-slot of the PM511V CPUs.

Figure 5-14. Example in 14-slots subrack of positioning of program cards and flash cards with application program dumps.

Chapter 6 Multiprocessor communication

6.1 General

The internal communication consists of data exchange between the PM511V in the subrack. The communication is performed via a common memory. This common memory is allocated on the carrier board SC510 which holds the submodule MB510 (flash card interface). See Chapter 5 *"Multiprocessor system considerations"*, in this chapter is described the positioning of circuit cards etc. and also the common memory.

The lower subslot on this SC510 board holding the MB510 **cannot be used**. If the lower subslot is used, the common memory will malfunction.

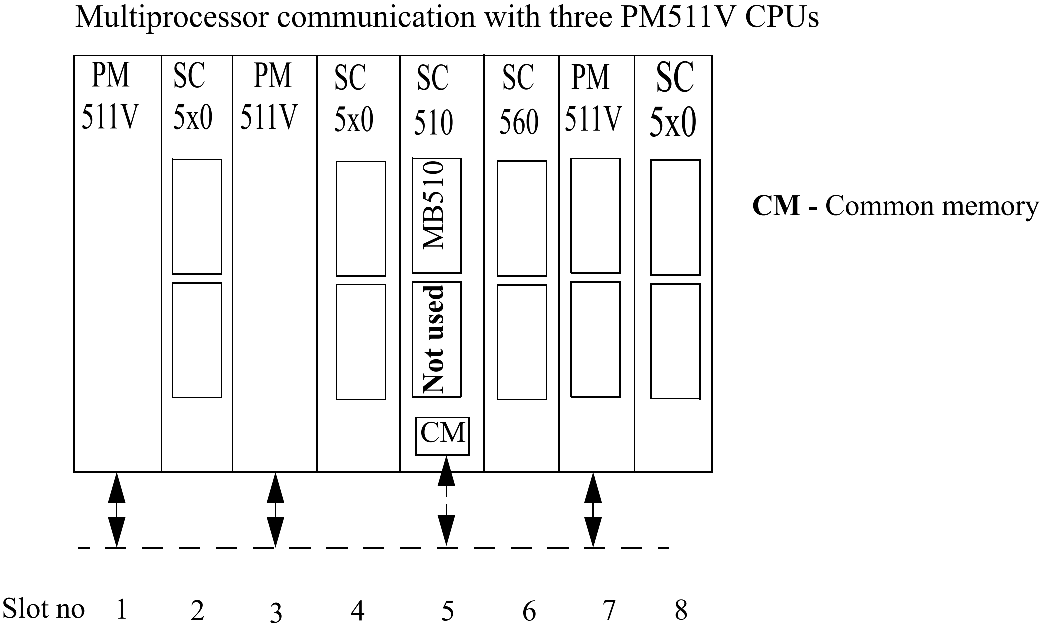


Figure 6-1. Example of common memory in 8-slots central rack with three PM511V CPU's.

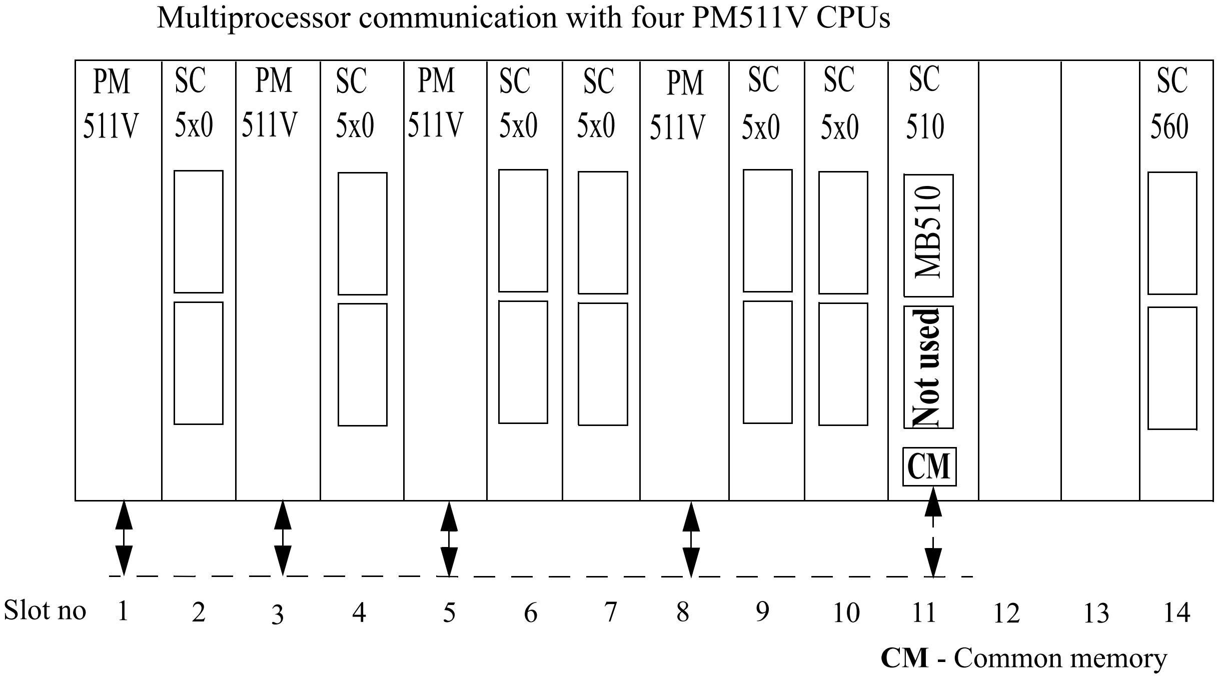


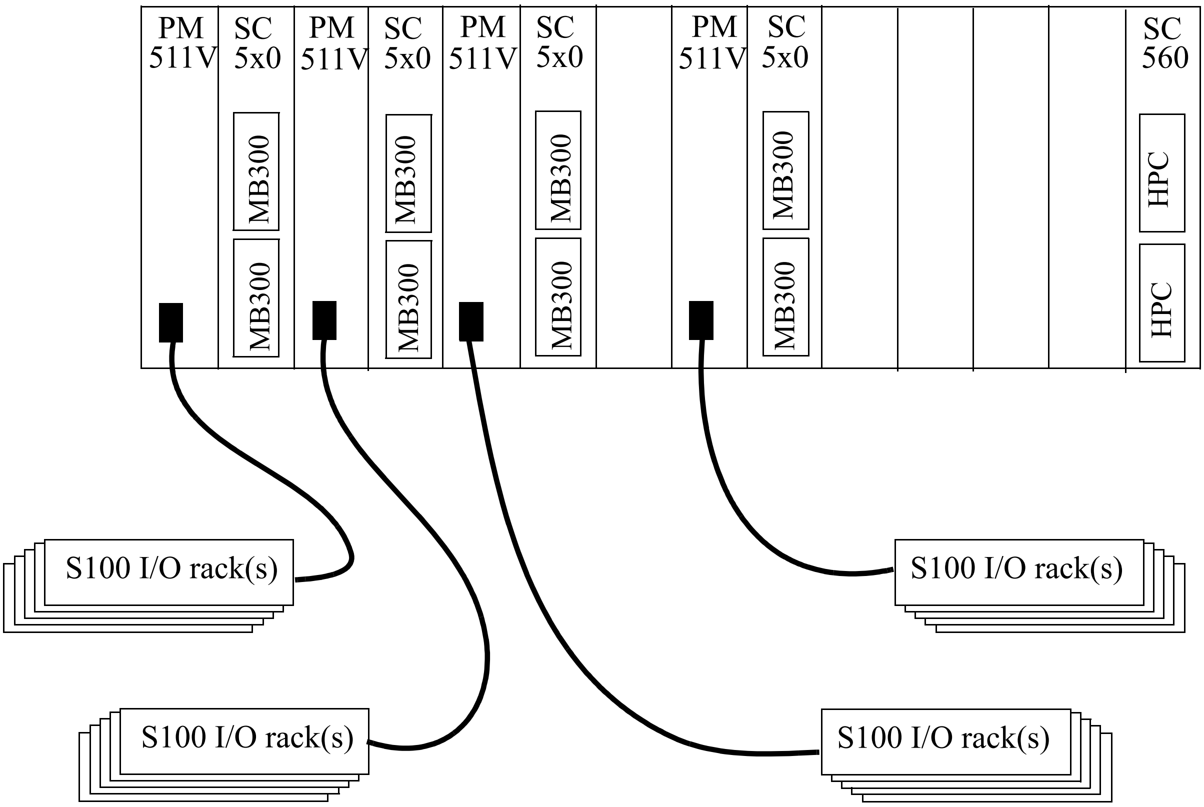
Figure 6-2. Example of common memory in 14-slots central rack with four PM511V CPU's.

Chapter 7 S100 I/O

7.1 General

In AC 450RMC multiprocessor systems each PM511V CPU may have a local S100 I/O bus.

Multiprocessor system with four PM510V CPUs.



Chapter 8 Backup of Application Program

8.1 Introduction

The application programs of the PM511V CPU in the AC 450RMC can be stored in a flash card (PCMCIA).

At COLD start and at RECONFIG the PM511V CPU is loaded automatic with the application program stored in the flash card. The PM511V CPU comes into the same mode as the PM511V CPU had when the application program dump (DUAP) was taken.

Guidelines

- Advant Station 130 Engineering Station (AS 130ES) and AdvaBuild On-line Builder together with the file manager (in Windows) support the preparation of flash cards (PCMCIA) with application dumps.

Considerations

- The system program backup and the application program backup cannot be mixed in one single flash card.
- The flash card for application backup must first be formatted using the AdvaBuild On-line Builder.
- The application program dump (DUAP) to be used should preferably be taken while the controller is in the operation mode (P1) with all PC-programs running. This will ensure that no manual intervention is needed to get into full operation after shut down and an automatic restart.
- Each PM511V CPU in the subrack has it own flash card which is positioned in the PCMCIA slot on the PM511V CPUs

At cold start the PM511V CPU’s will search for a flash card containing application programs. If a flash card is present, the PM511V CPU load the stored application dump.

8.2 Positioning of the flash card with application program dump.

The flash card with application dump is placed in the PCMCIA slot on the PM511V CPU. A flash card can only contain an application program dump for one PM511 CPU.

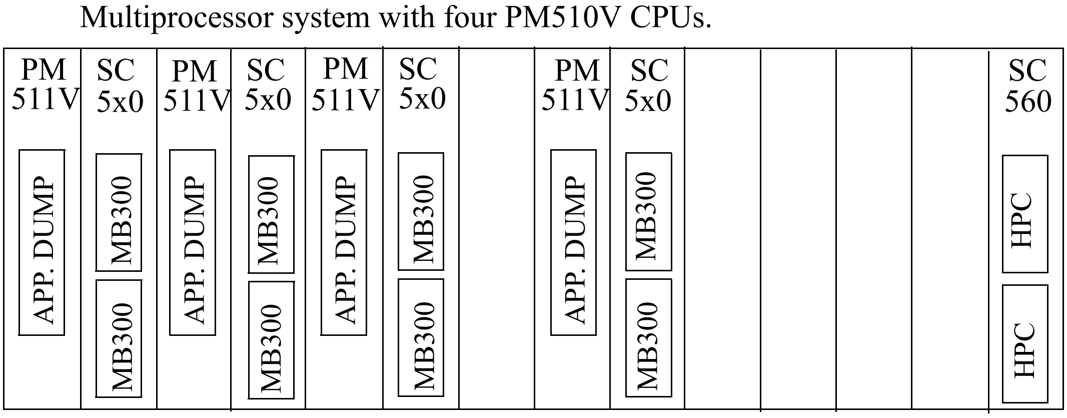


Figure 8-1. Application program dumps.

8.3 Label on the flash card

It is recommended to put a label on the flash card. The label should describe date and time revision of the application program dump files.

8.4 Installation of flash card in the AC 450RMC controller.

Insert the flash card with application program in the PCMCIA slot on the PM511V.

The application program card can be inserted online:

1. No configuration work is needed.
2. A new item representing the added program card will be created automatically in the system status display on the operator station.

The application program card is now ready for operation. However **you are advised to make functional tests of the backup** in a non-critical situation. I.e. perform a COLD start of the controller when a possible shut down is acceptable from a process control viewpoint.

Chapter 9 High Performance Communication bus

9.1 General

High Performance Communication bus (HPC) is a fast, low-load, Local Area Network (LAN) for interconnection of MP 200/1 RMC, AC 450RMC, AC 800M or AC 800PEC controllers in multi-drop configurations. (AC 800M and AC 800PEC controllers need RMC libraries with the HPC function.)

Carrier board SC 560 is used for the protocol stack; otherwise the same hardware applies to both HPC and to MB300.

The PC elements HPC-WR and HPC-RD are used for communication on PC program level. The data is routed by network, node and a channel identity. HPC-WR is used for sending of data and HPC-RD for reading of data.

Several HPC-RD elements can read data from the same HPC-WR element. The HPC-RD elements may even be located in all CPU systems within a multiprocessor system. HPC messages may also be broadcasted to all nodes within a network.

9.2 Performance

Maximum size of a HPC messages is 970 byte.

An Advant Controller 450RMC station may have up to four HPC links where each SC 560 carrier board supports two links. A HPC network may contain up to 127 nodes.

A maximum forty receiving channels can be designated to a specific node. The total number of receiving channels for one HPC node is limited to 80 channels.

The message flow through the HPC communication board SC560 is limited to 600 messages/s for small message (typically < 200 bytes) messages.

9.3 Submodule CS513

The submodule is placed on the carrier board SC560. The s CS513 is used as an communication interface for the HPC-bus. The board contains an Integrated Local Area Communication Controller which realizes the physical level of communication defined in the IEEE 802.3 standard.

Note:
HPC does not support the CS513A board.

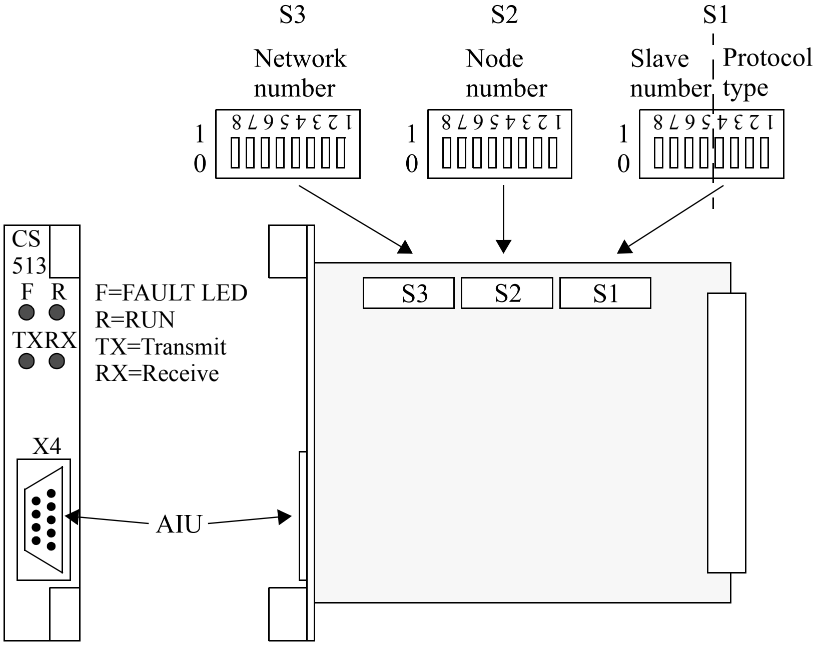


Figure 9-1. HPC communication interface CS513

9.3.1 Strappings

Selection of slave number and protocol number on switch S1

The protocol type, defined by bits 1 - 4, are always set to 0.

The slave number, defined by bit 5 -8, where bit 5 always is set to 1 and bits 6 - 8 always are set to 0.

Selection of network on switch S3 and node number on switch S2

The HPC network number set on switch S3 is selected between 1 - 127.

The HPC node number (1 - 127) set on switch S2 must be unique within a HPC network. If a process station is connected to MB300 and only contains one HPC board then it is recommended to use the same node number for the HPC network and MB300 network.

9.3.2 SC 560 Carrier Board

The function of SC 560 is to act as an intelligent carrier for different kinds of I/O-modules, such as:

- communication modules for HPC, CS513 (LAN IEEE 802.3)
- asynchronous communication modules for CI 530 series, RCOM, MVI, RS-232-C, MasterFieldBus or Advant FieldBus 100
- program card interface board for system software, MB510.

The board has mechanical provisions for two I/O modules, both inserted from the front of the SC 560. You can remove or change the I/O modules without removing the base board from the FB+ back-plane.

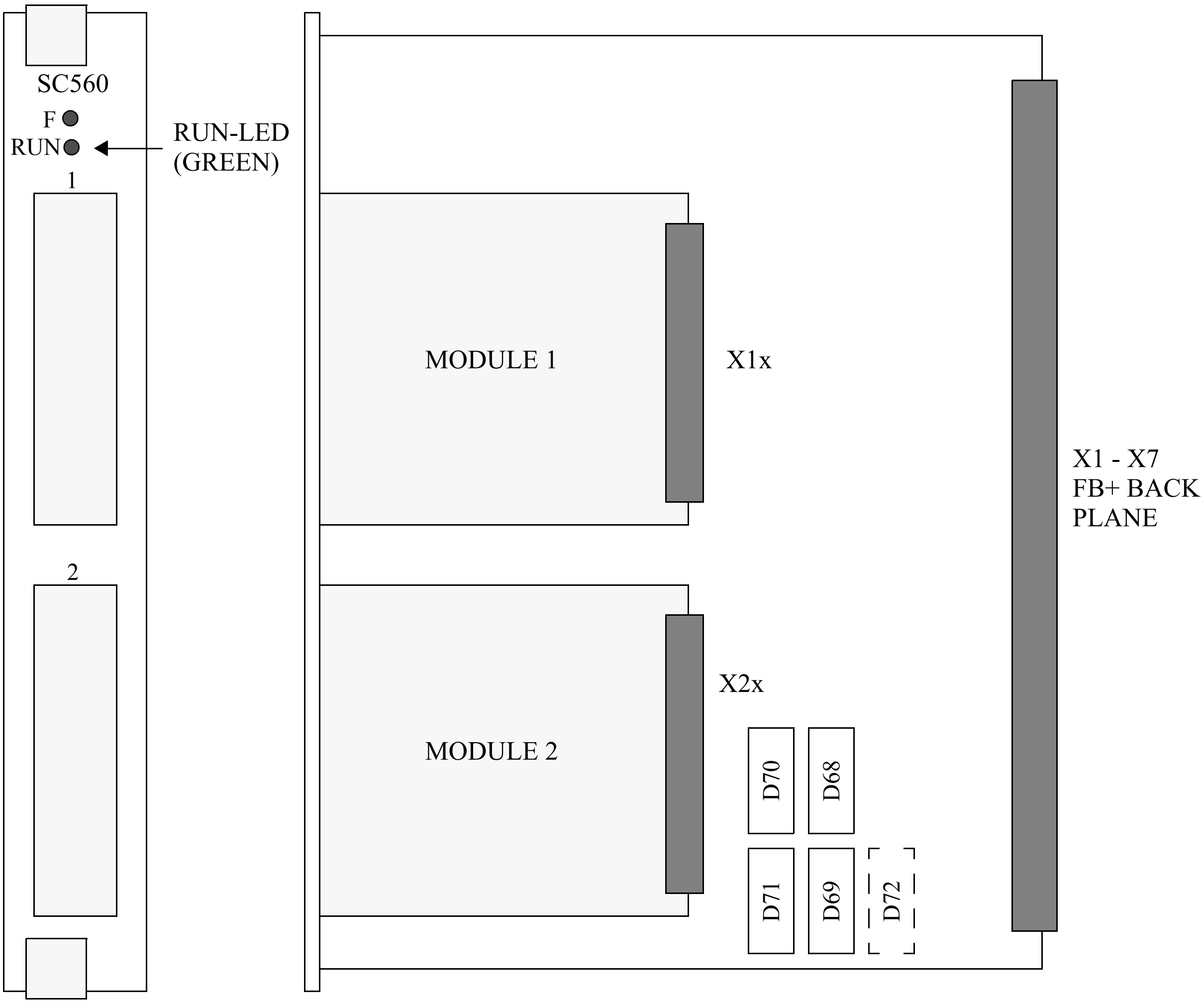


Figure 9-2. Carrier board SC 560

CONNECTORS X1-X7

The rear connectors, X1-X7, contains the connection to the FB+ back-plane.

X1x and X2x

These connectors on the base board, accessible through the front, are the connectors to the Module Interconnection Bus, MIB. The connectors designated X1x corresponds to the module position 1 and X2x to module position 2. Module 1 is the upper module, as viewed from the front, and module 2 is the lower module.

PROM locations

The SC 560 board has five sockets for PROM located near the lower edge of the board. Four sockets (D68 - D71) are intended for the "main program memory" and the fifth sockets (D72) is not used.

Chapter 10 VIP, Vendor Internet Protocol (TCP/IP)

10.1 General

The VIP function supports Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) built on the Internet Protocol (IP) for ethernet.

The Vendor Internet Protocol (VIP) function is included in the option module QC04-VIP01.

10.2 Hardware and Strapping

The CI546 module is available as TCP/IP network interface for the VIP function.

10.2.1 Communication Interface CI546

CI546 is a small circuit board adapted to the Module Interconnection Bus (MIB) and intended for insertion in SC510 and SC520. The board contains:

- a CPU (MC68360)
- an integrated Local Area Communication Controller which realizes the physical level of communication defined in IEEE 802.3 standard
- RWM
- PROM which contains the TCP/IP communication stack.

.

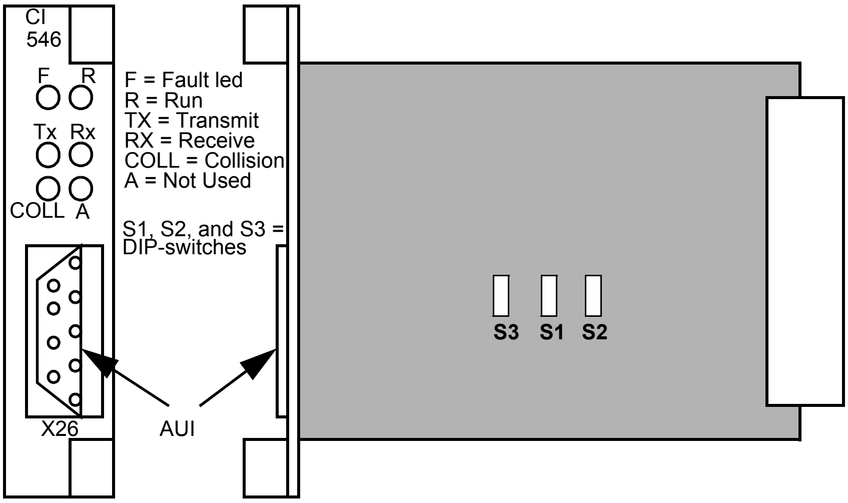


Figure 10-1. CI546

DIP-Switches

The DIP-switch S1 is used for node number. The DIP-switches S2, and S3 are NOT used.

CAUTION

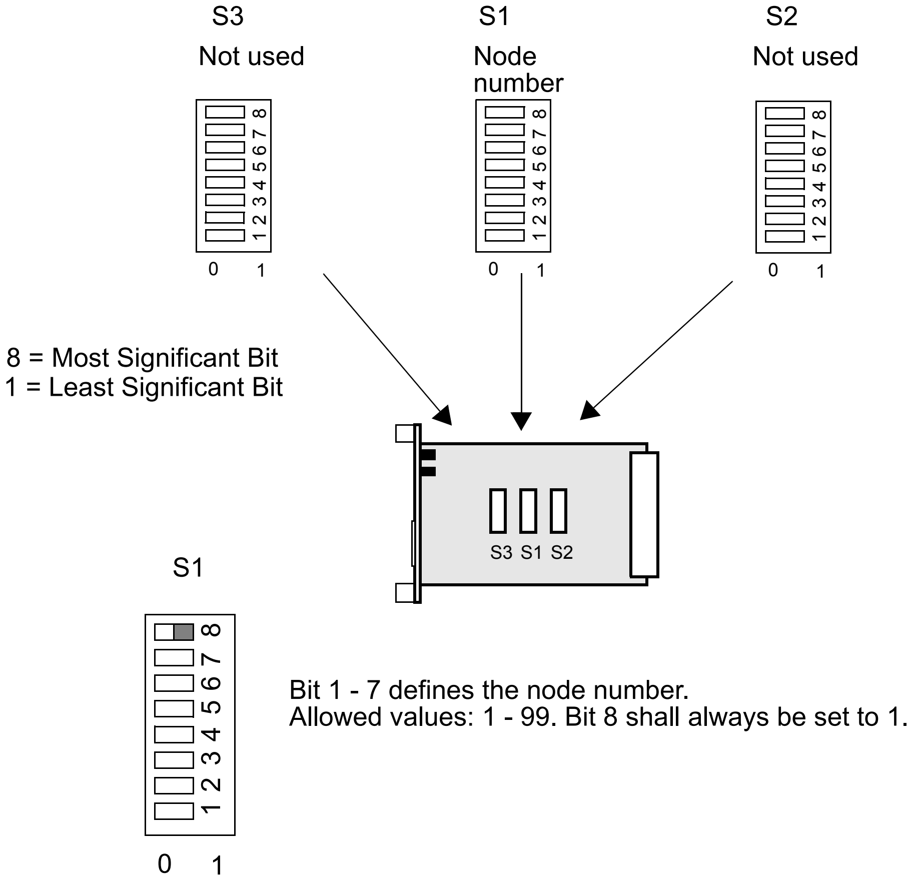
Always disconnect the transceiver cable (DSTK 128/129, TK 576Vxxx) from the X26 contact of CI546 before inserting or removing CI546.

NOTE

CI546 should not be mounted on the same carrier board as CS513 or CS513A modules for MB300 communication.

SC510 and SC520 carrier board holding the CI546 submodule must not be shared with other main CPU’s. SC560 carrier board can however be shared.

10.2.1.1 Strappings on CI546



8 = Most Significant Bit
1 = Least Significant Bit

Bit 1 - 7 defines the node number.
Allowed values: 1 - 99. Bit 8 shall always be set to 1.

Figure 10-2. CI546 Strap Groups

10.3 Configuration

Configuration of communication links is done by means of a data base element and the PC elements below.

VIP-NETW	Configuration of network
VIP-NODE	Configuration of nodes
VIP-LINK	Configuration of links
VIP-CHAN	Configuration of channels

A configuration can be illustrated as a tree structure according to Figure 10-3.

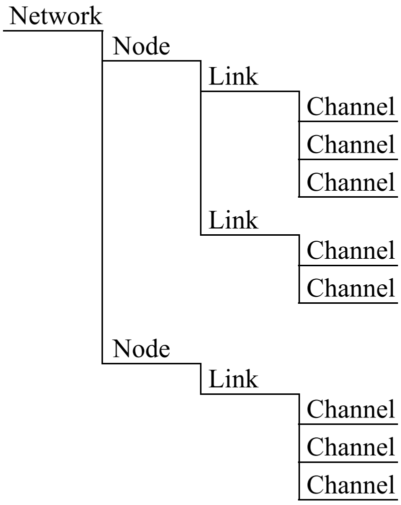


Figure 10-3. Configuration Tree

10.3.1 Network Configuration

DB element CI532 and PC element VIP-NETW is used for configuration of the network. The element constitutes the interface to the MasterNet function that will associate the network interface with a MasterNet network number.

The PC element VIP-NETW is used for initialization of the DB element and applying an internet address and a host name for the network interface. Internet address for gateway and remote network can also be specified for the network.

NOTE

A CI532 DB element must be created for each network interface card. The IMPLEMENTED property must be set to 0 by the user to allow the PC element VIP-NETW to initialize the DB element.

10.3.2 Node Configuration

The PC element VIP-NODE is used for associating a MasterNet node number for each external computer connected the same MasterNet network. An internet address is specified for each node number. Optionally a host name may be specified for each node.

10.3.3 Link Configuration

The PC element VIP-LINK is used for configuration of links to an external computer. The parameter listed below are used for definition of a link.

- Port (service), well defined and known by both end of the link
- Protocol
- Direction of the link: send, receive or bidirectional
- Transport protocol type: TCP or UDP
- Client or server for TCP links

10.3.4 Channel Configuration

The PC element VIP-CHAN is used for configuration of message channels for a link. Each channel is associated with a specific application message, i.e. one channel is created for each message type. A sending channel is used as an interface to the transmitting PC element VIP-W. A receiving channel is used as an interface to PC element VIP-R. A message queue is confederated for each receiving channel to be able to queue application messages when event driven communication is used.

10.3.5 Application Message Configuration

Configuration of an application messages is implicitly defined by PC element VIP-W for sending messages and VIP-R for receiving messages. Each PC element is connected to a message channel created by PC element VIP-CHAN.

The order, and the data types that are supported by the PC elements are listed below.

- 16 bit integer values
- 32 bit integer values
- Real values
- Group data arrays
- Byte array arrays

The total number of data inputs/outputs is limit to 45 terminals per PC element. PC elements can be linked to handle larger application messages.

The format of the message is specified by means of PC element VIP-CHAN element, e.g. byte arrays can be null terminated or the size of the array may be included.

The interpretation of an application message is implicitly defined by the configuration of the corresponding VIP-R PC element. The order of the data item in the message is assumed to be the same order as the order of the data output terminals of the PC element.

10.3.6 MasterBus 300 Routing

VIP messages can be transmitted/received in any AC450 node that is connected to the same MB300 network as the node containing the TCP/IP interface module.

Node 2 in Figure 10-4 below act as a transit node for node 1,3 and 4. Network 11 is used for node 3 and 4, and network 12 is used for node 1. Node 2 is not directly connected to network 13 and cannot act as a transit node for node 5.

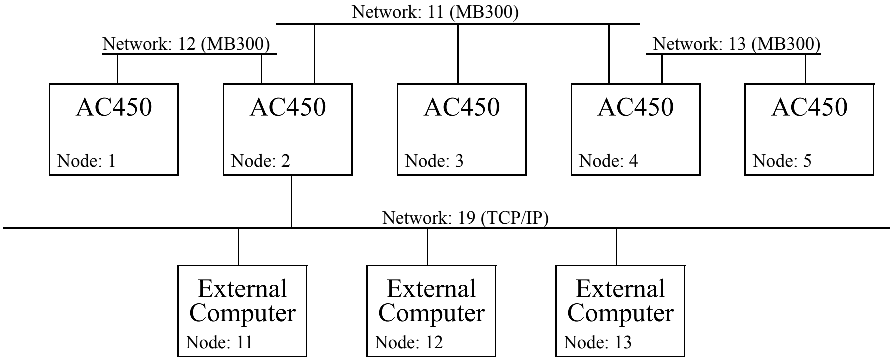


Figure 10-4. MB300 Routing Example

The routing scheme is determined by PC element VIP-CHAN. A message received from an external node is routed to all nodes containing a PC element VIP-CHAN defining the channel associated with the message. A node sending a message to an external computer must contain the VIP-CHAN element defining the sending channel.

NOTE

The real time performance in the transit node and on the MB300 network cable should be considered when large amount of transit traffic is used.
Refer MasterNet™ User's Guide.

Chapter 11 Advanced Control Module (ACM)

11.1 General

The Advanced Control Module (ACM) is normally used for calculations of a process model.

The ACM node consists of the following hardware:

- PM510V CPU
- Carrier board SC510 with the submodule MB510.

The MB510 is the interface for the flash card which is loaded with software for e.g. the process model.

The ACM node communicate with the PM510V CPU in slot no 1.

The ACM node uses cold start and the mode selector on PM510V CPU must always be in position 3 = CLEAR.

The ACM can be used both in an AC 450RMC single system and in an AC 450RMC multiprocessor system.

11.2 ACM node in the subrack 8-slots subrack

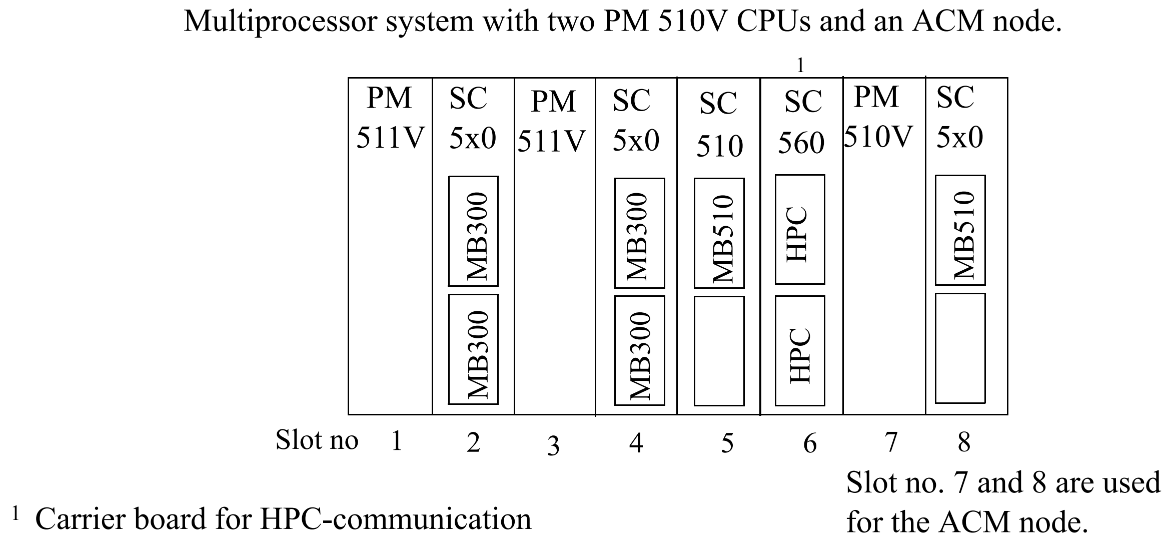
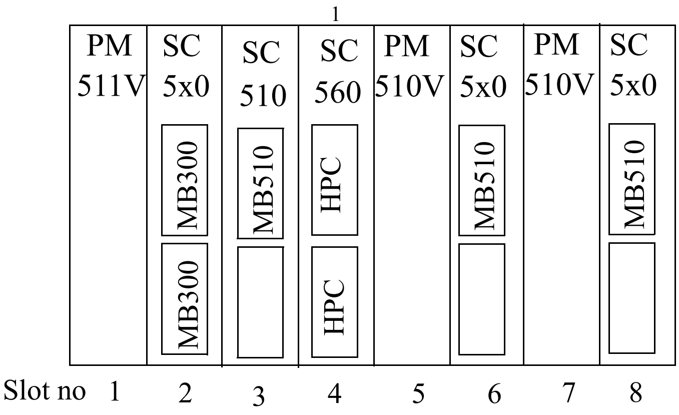

Multiprocessor system with two PM 510V CPUs and an ACM node.
1
PM 511V
SC 5x0
PM 511V
SC 5x0
SC 510
SC 560
PM 510V
SC 5x0
MB300
MB300
MB300
MB300
MB510
HPC
HPC
MB510
Slot no
1
2
3
4
5
6
7
8
Slot no. 7 and 8 are used for the ACM node.
1 Carrier board for HPC-communication

Figure 11-1. Example with ACM in a multiprocessor system with two CPUs in the 8-slots subrack.

If two ACM nodes are used, the first ACM-node is positioned in slot no 7 and slot no 8. The second ACM node is positioned in slot no 5 and 6. The second ACM node affects the position of the other circuit boards in the rack.

Single CPU system with two ACM nodes.



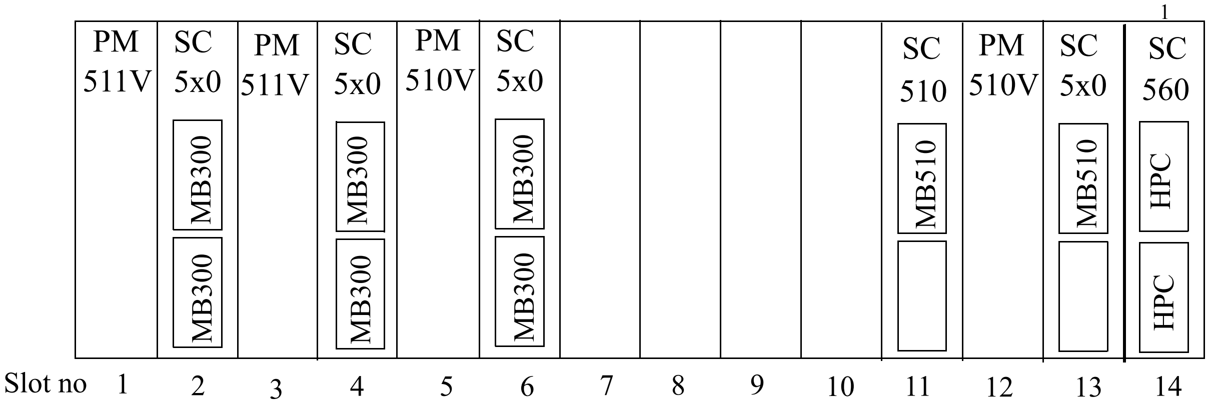
[1] Carrier board for HPC-communication

Slot no. 7 and 8 are used for the first ACM node. Slot no. 5 and 6 are used for the second ACM node.

Figure 11-2. Example with ACM nodes in a single CPU system.

11.3 ACM node in the subrack RF522

Multiprocessor system with three PM 511V CPUs and an ACM node.



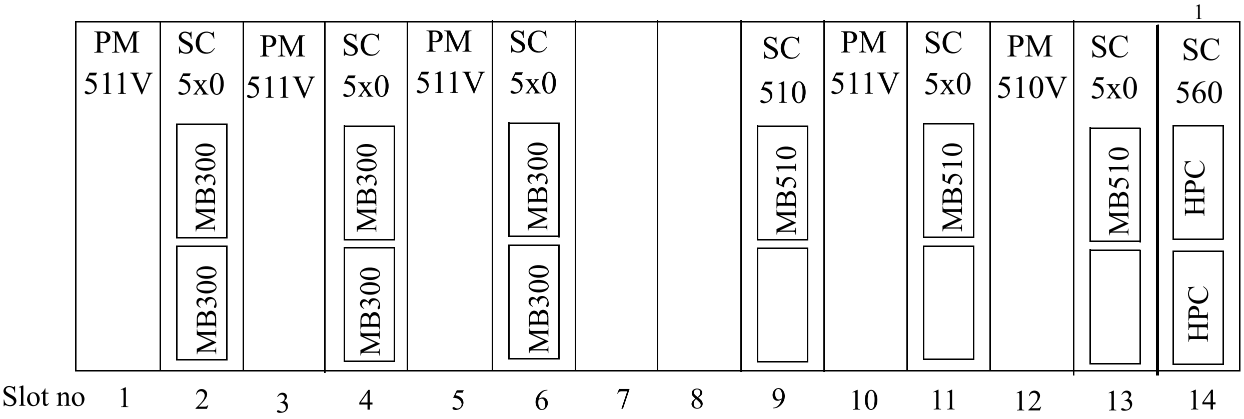
[1] Carrier board for HPC-communication

Slot no. 12 and 13 are used for the ACM node.

Figure 11-3. Example with ACM node in a multiprocessor system with three CPUs in the 14-slots subrack.

If two ACM nodes are used, the first ACM-node is positioned in slot no 7 and slot no 8. The second ACM node is positioned in slot no 5 and 6. The second ACM node affects the position of the other circuit boards in the rack.

Multiprocessor system with three PM 511V CPUs and two ACM nodes.



[1] Carrier board for HPC-communication

Slot no. 12 and 13 are used for the first ACM node.

Slot no. 10 and 11 are used for the second ACM node.

Figure 11-4. Example with ACM nodes in a multiprocessor system with three CPUs.

Chapter 12 System message handling

12.1 General

CPU systems that are not connected to a MasterBus 300 network automatically forward their system messages to the leftmost CPU system that is connected to MB300.

Layout of system messages from a CPU system without MB300:

1 1 Sn*<time> <mtype> <code> <task> <address> <data1> <data2>

Where n = Slot number of current CPU-board PM511V.

Chapter 13 Start-up of the multiprocessor system.

13.1 General

Advant Controller 450RMC has four working modes. The CPU PM511V front LED display indicates the working modes with codes “P1”, “P2”, “-3” and “-4”.

“P1”, working mode OPERATION:

> The CPU executes the application program. This is an Advant Controller 450RMC normal status. The system performs control tasks and controls process outputs.

“P2”, working mode CONFIGURATION:

> The CPU does not execute the application program. The controller system and the application program can now be configured.

“-3”, working mode STOPPED:

> The CPU does not execute at all. The CPU performs self-tests of some basic controller functions. The process outputs have a defined state (zero).

“-4”, working mode OFFLINE:

> The CPU executes only low-level fault-tracing commands usually performed by ABB personnel. The process outputs have a defined state (zero).

During the boot phase and during the time of transition between certain working modes the LED display will indicate intermediate states with the help of a sequence of special codes. These codes are relevant at fault finding and system analysis.

The multiprocessor system can be started up with a Global start-up or a Local start-up.

13.2 Global start-up

A start-up order on one CPU PM511V restarts all CPUs (PM511V) in the subrack (FB+).

When the LED-segments of CPU PM511V display codes according to figure 5-1 a global start-up is performed.

Note: At COLD start, of the PM511 CPU, is the global start-up function activated first after about 5 minutes after that “P2” is seen on the LED-display on the PM511 CPU. At COLD start is the PM511 CPU booted with system softwares stored on the program card.

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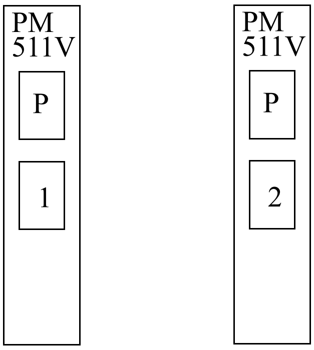


Figure 13-1. Global start of the CPU PM511V.

13.3 Local start-up

Start-up order on one CPU PM511V restarts current CPU PM511V in the subrack (FB+).

The very first start of the multiprocessor system is local. At this start the system software on the program card is loaded into the CPU and the application memory area in the CPU is cleared.

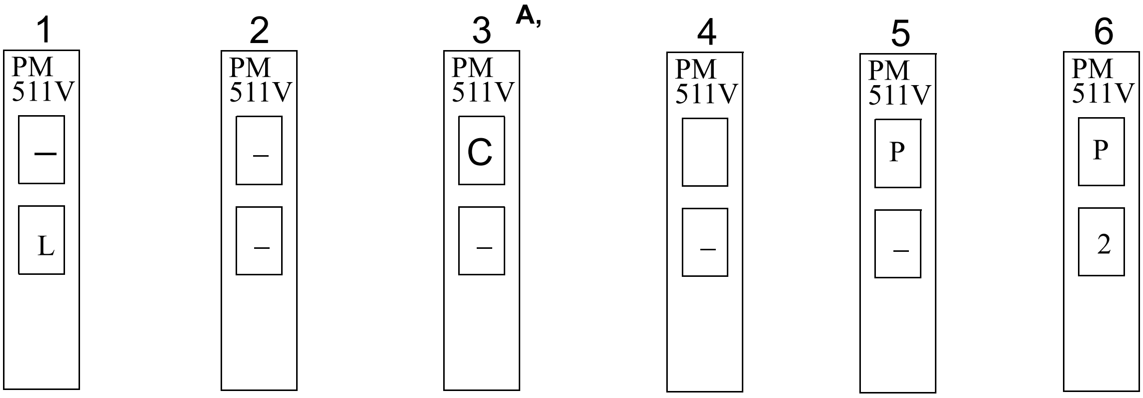
Local start is performed when the LED-segments of CPU PM511V display other codes than those in figure 5-1.

13.4 Start modes of the CPU PM511V

13.4.1 COLD start

Switch the start mode selector on PM511V into position 3 = CLEAR and press the push-button "ENTER" (or give a RECONFIG-command from a MasterAid) and the CPU PM511V is started up with a COLD start.

In figure 5-2 the COLD start sequence is described.



1: PM511V search for program card.

2: PM511V access the program card.

3: CLEAR-mode of the PM511V. Installation of system software

4: Memory test and initialization of system software.

5: Initialization of system functions.

6: The COLD start is finished.

Note A: The COLD start sequence can be restarted again from here.

Figure 13-2. COLD start of the CPU PM511V.

If error occurs while accessing the program card an error code is displayed on the CPU LEDs.

Following errors are detected:

E1	The PM511V has found that the program board is incorrect positioned relative PM511V.
E3	An error has been detected when transferring system softwares from the program card to the PM511V.
E4	Error in handshaking between the program card and the PM511V.
E5	Error occurred when starting up the CPU.

The error code is displayed with “E” on the upper LED-display and the number on the lower LED-display.

13.4.2 AUTO start

The CPU PM511V is started with an AUTO start (e.g. switch on PM511V is set in position 1 = AUTO and the button ENTER is pressed).

In the figure 5-3 the AUTO start sequence described.

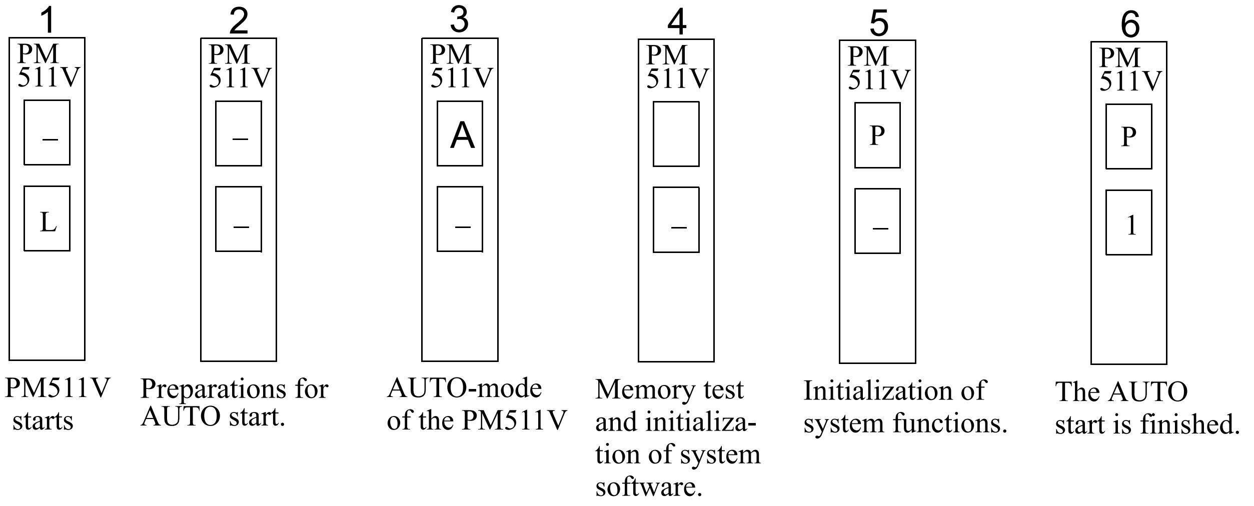

1
PM 511V
–
L
PM511V starts
2
PM 511V
–
–
Preparations for AUTO start.
3
PM 511V
A
–
AUTO-mode of the PM511V
4
PM 511V
–
Memory test and initialization of system software.
5
PM 511V
P
–
Initialization of system functions.
6
PM 511V
P
1
The AUTO start is finished.

Figure 13-3. AUTO start current CPU PM511V.

13.4.3 ECONFIG, DICONFIG and RECONFIG

At commands ECONFIG, DICONFIG and RECONFIG given from Engineering Station will restart the other CPUs PM511V.

In figure 5-4 the start sequence from configuration mode and the command DICONFIG is described.

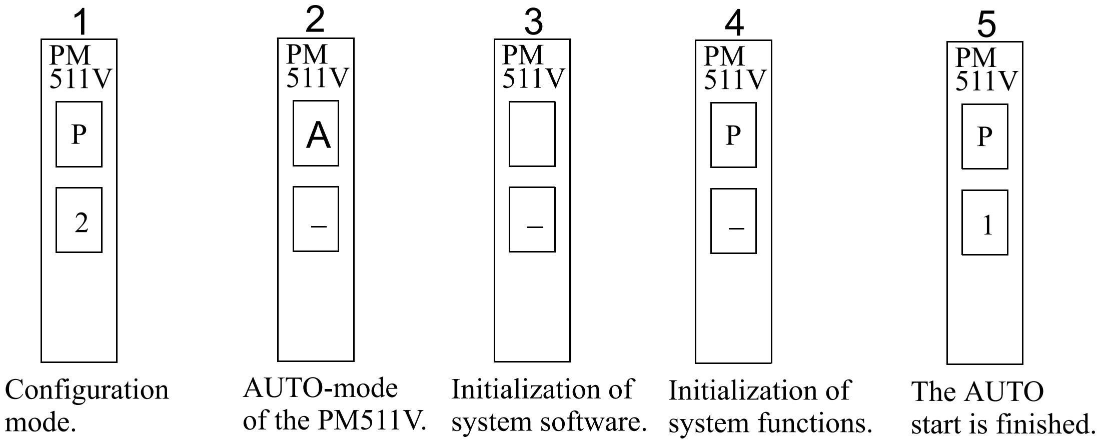

1
PM 511V
P
2
Configuration mode.
2
PM 511V
A
–
AUTO-mode of the PM511V.
3
PM 511V
–
Initialization of system software.
4
PM 511V
P
–
Initialization of system functions.
5
PM 511V
P
1
The AUTO start is finished.

Figure 13-4. The DICONFIG-command of current CPU PM511V.

For RECONFIG see chapter 5.4.1 *COLD start*.

Chapter 14 Battery backup

14.1 General

The power supply system for Advant Controller 450RMC includes a battery package intended for current supply for RAM (Random Access Memory) and the system clock of the CPU-boards PM511V in event of a power failure in the subrack.

The backup power supply is supervised. Status is available for the CPU-boards PM511V by the controller diagnostic system.

At power-up the CPUs starts with an AUTO-start or a COLD-start.
AUTO-start is preformed when the status of the battery is okay.
COLD-start is performed when the battery has been discharged.

Chapter 15 Limitations

15.1 General

See chapter 5 **Multiprocessor system considerations** concerning positioning of circuit boards in the subrack.

15.2 Data base handling in AC 450RMC

The AC 450RMC in single and multiprocessor configurations:

- each PM511 CPU has its own database.
- each PM511 CPU has its own S100 subrack(s), if S100 I/O is used.
- each PM511 CPU has its own S800 remote I/O, if S800 I/O is used.

Chapter 16 Memory map for special RMC I/O boards

16.1 General

Table 12-1 Address jumpering of RMC boards below shows recommended addresses to be used for special RMC I/O boards.

Board	Address range		Remark
	Hexadecimal	**Decimal**	
DSDI 110	C0...EF	192...239	(For boards handled by BCD-RD)
DSDO 110	C0...EF	192...239	(For boards handled by BCDW-H1)
DSDP 140 B	C0...EF	192...239	
DSDP 160	C0...EF	192...239	
DSDP 161	C0...EF	192...239	

Table 16-1. Address jumpering of RMC boards.

Chapter 17 Positioning

17.1 Database element TIME_DIS for positioning control

17.1.1 Summary

The Digital input element TIME_DIS holds the data values of the properties associated to a digital input channel. Besides this special properties for very accurate time tagging is available.

The element is subordinated to the DI-board DSDI 110 or DSDI 120.

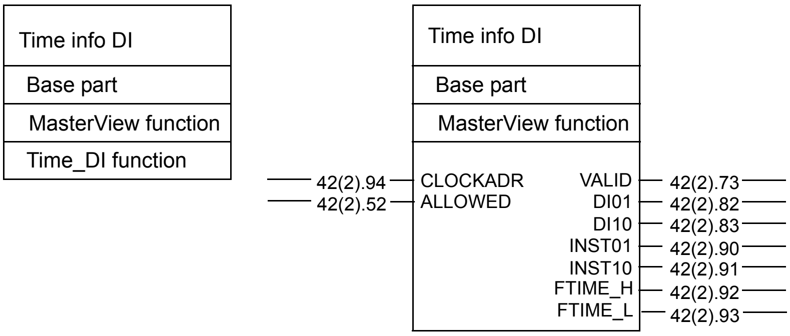


Figure 17-1. TIME_DIS element

See manual “DATA BASE ELEMENT” concerning “Base part” and “Operator Station function” of the element.

17.1.2 Properties

Terminal No.	Name	Value entered by user	Default value	PC connection data type	Description
52	ALLOWED	user	0	-	127=the time tagging is activated.
73	VALID	system	-	B	1=the time information is valid.
82	DI01	system	-	B	Is set at positive transition.
83	DI10	system	-	B	Is set at negative transition.
90	INST01	system	-	I	Event time for the last 0 to 1 transition at the digital input.
91	INST10	system	-	I	Event time for the last 1 to 0 transition at the digital input.
92	FTIME_H	system	-	I	The duration of the last 0 to 1 pulse at the digital input.
93	FTIME_L	system	-	I	The duration of the last 1 to 0 pulse at the digital input.
94	CLOCKADR	user	-	H*4	Address to clock board DSDP 150. The address format is H'0700xx00, where xx is the jumpered board address which is read as a hexadecimal number e.g. xx= D0 (hexadecimal) represent the integer number 192.

Table 17-1. Properties for TIME_DIS

17.1.3 Function

The circuit board DSDP 150 contains a ring counter used as a clock for time tagging of DI events. The initiating of the clock is performed by the PC element CLCK-H1. The resolution of the clock is one millisecond. The maximum pulse time possible to register is 32 seconds. The maximal difference between the actual time at the digital input and the registered time in the database is 3.1 ms. The average difference is 1.55 ms.

The properties INST01, FTIME_H and FTIME_L will be updated only if property DI01 is reset when a positive transition occurs.

17.1.4 Connection

The PC element TIME-H1 has to be connected to property number 95 (ADDR) that is not visible in the database element.
To connect TIME-H1 to ADDR following the syntax can be used: "=DIx.y:42(2).95" where x is board number and y is the channel number.

17.2 Jumpering of DSDP 140B

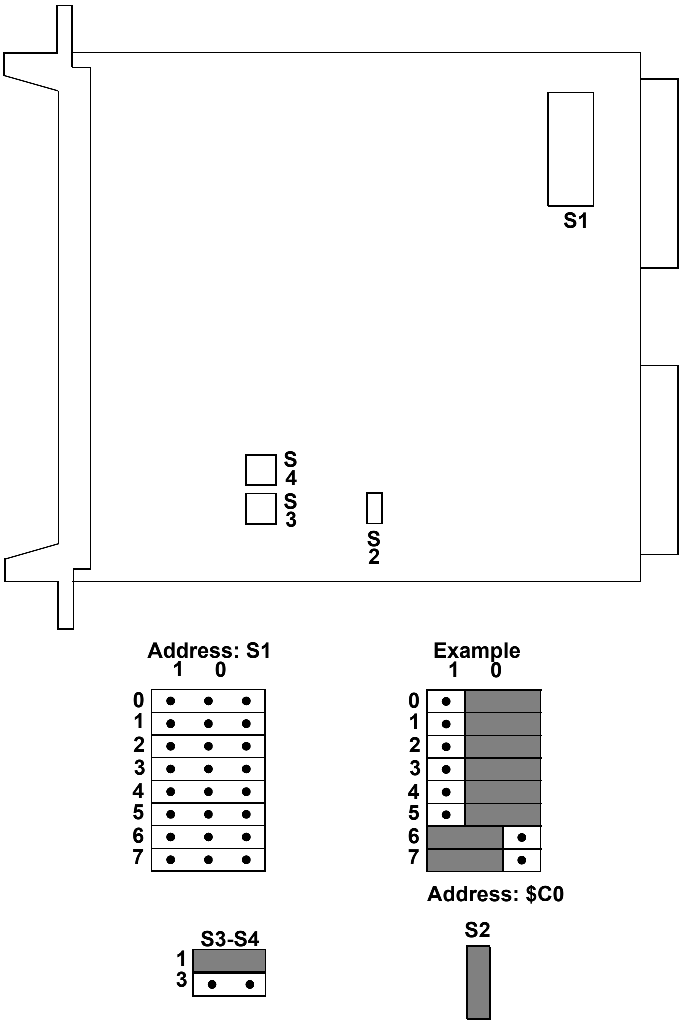


Figure 17-2. DSDP 140 jumper groups

17.3 Jumpering of DSDP 150 for shear control

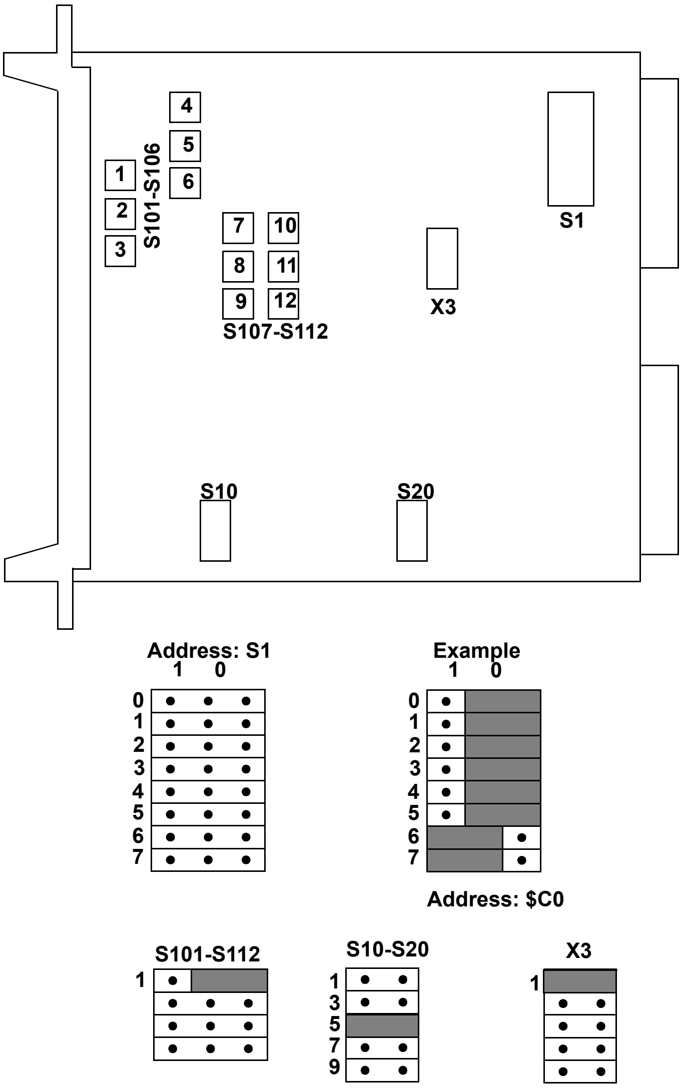


Figure 17-3. DSDP 150 jumper groups

Chapter 18 Loop measurement

18.1 Jumpering of DSDP 160

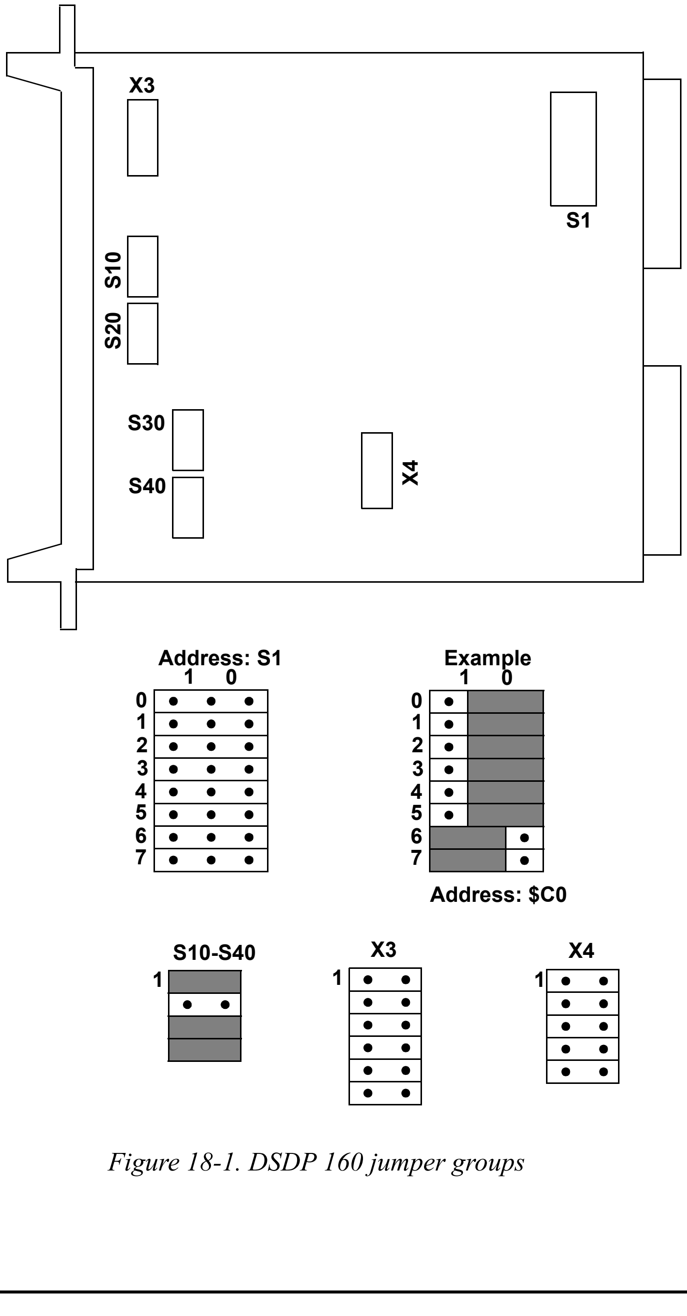


Figure 18-1. DSDP 160 jumper groups

18.2 Jumpering of DSDP 161

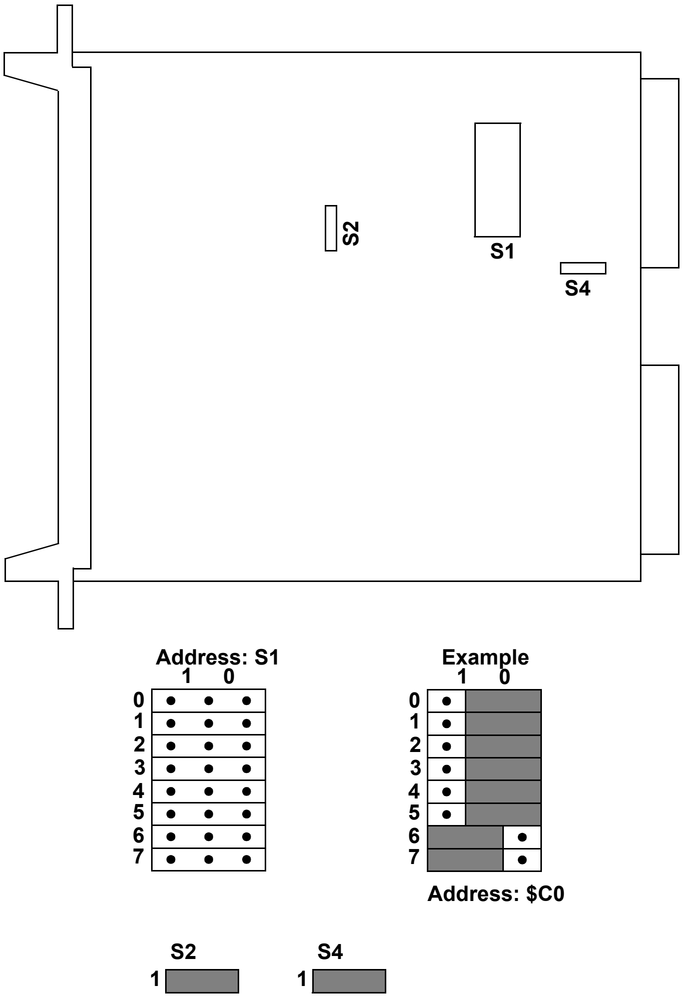


Figure 18-2. DSDP 161 jumper groups

Chapter 19 Fault analyses

19.1 General

If error occurs see the manual “Advant Controller 450 User’s Guide” for fault tracing.

19.2 When the system goes down

When a serious error occurs, the CPU PM511V goes down.

When this happens it is very important to print out system information from the faulty CPU. The print out information is then to be forward to your ABB representative.

19.2.1 Print out system information

Set the start mode selector on the front of the faulty PM511V, in position “OFFLINE” and press the “ENTER” push button. In this mode the CPU executes low-level fault-tracing commands only.

Connect a printer to the Engineering Station to print out information from the system.

Connect the Engineering Station to the faulty PM511V.

Use the AdvaBuild On-line Builder. Select the product “Advant Controller 400” form the menu of “Supported ABB Master Products”. After this selection is performed a new menu “Available Activities” is displayed. Select the activity “Post Mortem Analysis”.

When the session between Engineering Station and the faulty PM511V has been established, give the command “HARDCOPY ON” (all operations and results will be printed).

Give following commands:

SHTARG	**SH**ow **TARG**et system
LSYSM ALL	**L**ist old and remaining **SYS**tem **M**essages **ALL**.
LSYSHI	**L**ist **SYS**tem **HI**story.
LTIMQ	**L**ist **TIM**er **Q**ueues.
LTSL	**L**ist **T**ask **S**witch **L**og.
LTRQ	**L**ist **T**imer **R**eady **Q**ueue

Note. In this mode of the CPU the communication speed between the CPU and the Engineering Station is reduced. At communication the LED-diodes marked “LO” on the CPU will flash (instead of the LED-diodes marked “HI”).

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